Solutions for Powertrain

Siemens Project Manual for Production (SINUMERIK) –
Daimler Requirement Specification 2021

TRANSLINE
2021 Edition

https://support.industry.siemens.com/cs/ww/en/view/109764218

Siemens Industry Online Support

Legal information

Warning concept

This manual contains information that you must observe in order to ensure your own personal safety, as well as to avoid material damage. The notices referring to your personal safety are highlighted in the manual by a safety alert symbol. Notices referring only to equipment damage have no safety alert symbol. Depending on the hazard level, warnings are indicated in descending order as follows.

⚠ **DANGER**	**Indicates that death or severe injuries will result if proper precautions are not taken.**

⚠ **WARNING**	**Indicates that death or serious injury can result if proper precautions are not taken.**

⚠ **CAUTION**	**Indicates that minor personal injury can result if proper precautions are not taken.**

NOTICE	**Indicates that property damage may result if proper precautions are not taken.**

If more than one level of danger is simultaneously applicable, the warning notice for the highest level is used. A notice warning of injury to persons with a safety alert symbol may also include a warning relating to property damage.

Qualified personnel

The product/system described in this documentation may be operated only by personnel qualified for the specific task in accordance with the relevant documentation, in particular its warning notices and safety instructions. Qualified personnel are those who, based on their training and experience, are capable of identifying risks and avoiding potential hazards when working with these products/systems.

Proper use of Siemens products

Please note the following:

CAUTION

Siemens products may only be used for the applications specified in the catalog and in the associated technical documentation. If third-party products and components are deployed, then they must be recommended or approved by Siemens. To ensure trouble-free and safe operation of the products, they must be transported, stored, assembled, installed, commissioned, operated and maintained appropriately. The permissible ambient conditions must be complied with. Notes in the associated documentation must be observed.

Trademarks

All names identified by the trademark symbol ® are registered trademarks of Siemens AG. Other designations used in this document may be trademarks whose use by third parties for their own purposes could violate the rights of the trademark owners.

Disclaimer of liability

We have checked that the contents of this document correspond to the hardware and software described. Nonetheless, differences might exist and therefore we cannot guarantee that they are completely identical. The information given in this publication is reviewed at regular intervals and any corrections that might be necessary are made in the subsequent editions.

Security information

Siemens provides products and solutions with industrial security functions that support the secure operation of plants, systems, machines and networks.

In order to protect plants, systems, machines and networks against cyber threats, it is necessary to implement – and continuously maintain – a holistic, state-of-the-art industrial security concept. Siemens products and solutions constitute only one element of such a concept.

Customers are solely responsible for preventing unauthorized access to their plants, systems, machines and networks. Such systems, machines and components should only be connected to an enterprise network or the internet if and to the extent such a connection is necessary and only when appropriate security measures (e.g. firewalls and/or network segmentation) are in place.

In addition, Siemens recommendations regarding appropriate protective measures should be observed. For more information about Industrial Security, please visit https://www.siemens.com/industrialsecurity.

Siemens' products and solutions undergo continuous development to make them more secure. Siemens strongly recommends that product updates are applied as soon as they are available and that the latest product versions are used. Use of (older) product versions that are no longer supported, and failure to apply latest updates, may increase the customer's exposure to cyber threats.

To stay informed about product updates, subscribe to the Siemens Industrial Security RSS Feed at https://www.siemens.com/industrialsecurity.

Table of contents

List of figures

List of tables

1 Introduction

Scope

This project manual collates the relevant sections of various documentation that is relevant in the Daimler context. It includes:

- Overview of Transline
- Hardware description (controls, operator panels, startup sets)
- General Software Guide
- Software Guide S7 GRAPH
- Software Guide S7 GRAPH Daimler
- HMI PRO sl Description of Functions
- Safety Integrated
- Parameterization of the plant network

Designation Daimler

In the following document, the name "Daimler" is used to refer to Mercedes Benz Cars and Daimler Truck AG.

Target group

This document is intended for project managers, hardware planners, and programmers.

2 Contact

2.1 Siemens on site

Project Management Siemens AG (central contacts in all cases)	
Mr. Matthias Döpfner DI MC MTS SY PTR Frauenauracher Strasse 80 91050 Erlangen, Germany Phone: +49 (173) 2573280 E-mail: matthias.doepfner@siemens.com	Mr. Andreas Gaupp RC-DE DI S-VS-D 1 TECH Edisonstr. 19, 74076 Heilbronn, Germany Cellphone: +49 (174) 1593193 E-mail: andreas.gaupp@siemens.com

Technical Contact Siemens AG, Siemens concept	
Mr. Philipp Schulz RC-DE DI S-VS-D 1 TECH Lindenplatz 2, 20099 Hamburg, Germany Cellphone: +49 (152) 54873959 E-mail: philipp.schulz@siemens.com	Mr. Andreas Fenske RC-DE DI S-VS-D 1 TECH Weissacher Str. 11 70499 Stuttgart, Germany Cellphone: +49 (174) 9695294 E-mail: andreas.fenske@siemens.com

Contact Siemens AG, Stuttgart
Mr. Timo Berg RC-DE DI S-VS-D 1 KAM Weissacher Str. 11, 70499 Stuttgart, Germany Cellphone: +49 (173) 3830296 E-Mail: timo.berg@siemens.com

Contact Siemens AG, Berlin
Mr. Thomas Schröder RC-DE DI S-AREA1 4 Nonnendammallee 101 13629 Berlin, Germany Phone: +49 (172) 3755244 E-mail: th.schroeder@siemens.com

X

Contact Siemens AG, Hamburg
Mr. Philipp Schulz RC-DE DI S-VS-D 1 TECH Lindenplatz 2, 20099 Hamburg, Germany Cellphone: +49 (152) 54873959 E-mail: philipp.schulz@siemens.com

Contact Siemens AG, Rastatt
Mr. Rudi Jetter RC-DE DI S-VS-D 1 KAM Weissacher Str. 11 70499 Stuttgart, Germany Phone: +49 (172) 7368336 E-mail: rudi.jetter@siemens.com

Contact Siemens AG, Gaggenau, Mannheim, Kassel
Mr. Stefan Körner RC-DE DI S-VS-D 1 KAM Dynamostr. 4 68165 Mannheim, Germany Phone: +49 (172) 6130535 E-mail: stefan.koerner@siemens.com

Contact Siemens, Poland, Warsaw
Mr. Bogdan Kietzman RC-PL DI MC MTS ul. Zupnicza 11 03-821 Warszawa, Poland Phone: +48 (22) 870-9172 E-mail: bogdan.kietzman@siemens.com

Siemens Industry, Inc., USA
Mr. Remski James RC-US DI VM-AU BD 5555 New King Drive Troy, MI 48098 Phone: +1 (248) 712 8721 Cellphone: +1 (248)761 7003 E-mail: james.remski@siemens.com

Contact Siemens Brazil, Sao Paulo
Mr. Lucas Moschen Martinez Siemens Ltda. RC-BR DI MC Av Mutinga, 3800 São Paulo-SP 05110-902 Brazil Phone: +55 11 99711-3563 E-mail: lucas.martinez@siemens.com

Contact Siemens Ltd., China, Beijing
Mr. Wen Jun Feng RC-CN DI VSS-AUTO COC-PT 7, Wangjing Zhonghuan Nanlu BEIJING 100102, China Phone: +86 (10) 64765837 Cellphone: +86 18001199792 E-mail: junfeng.wen@siemens.com

Contact Siemens S.R.L., Romania
Mr. Bogdan Stoicescu RC-RO DI S-REG Strada Preciziei, nr. 24 062204 Bucuresti, Romania Phone: +40 (21) 6296-361 Cellphone: +40 (727) 736037 E-mail: bogdan.stoicescu@siemens.com

Siemens-Daimler-Extranet
Registration via Ms. Liliana Mitroi DI MC MTS SY PTR Frauenauracher Strasse 80 91050 Erlangen, Germany Phone: +49 (9131) 17-39638 E-mail: liliana.mitroi@siemens.com

2.2 Siemens Technical Support

Siemens AG Support		
Service Control Center Germany	Phone:	+49 (911) 895-7444
TRANSLINE 2000 Support	Phone:	+49 (711) 137-3964
Spare parts and repairs	Phone:	+49 (911) 895-7448
Online support	http://support.industry.siemens.com	

2.3 Daimler

Daimler AG	
See Powertrain Requirement Specifications, Part III Electrics	

3 Fundamentals of the "Transline" concept

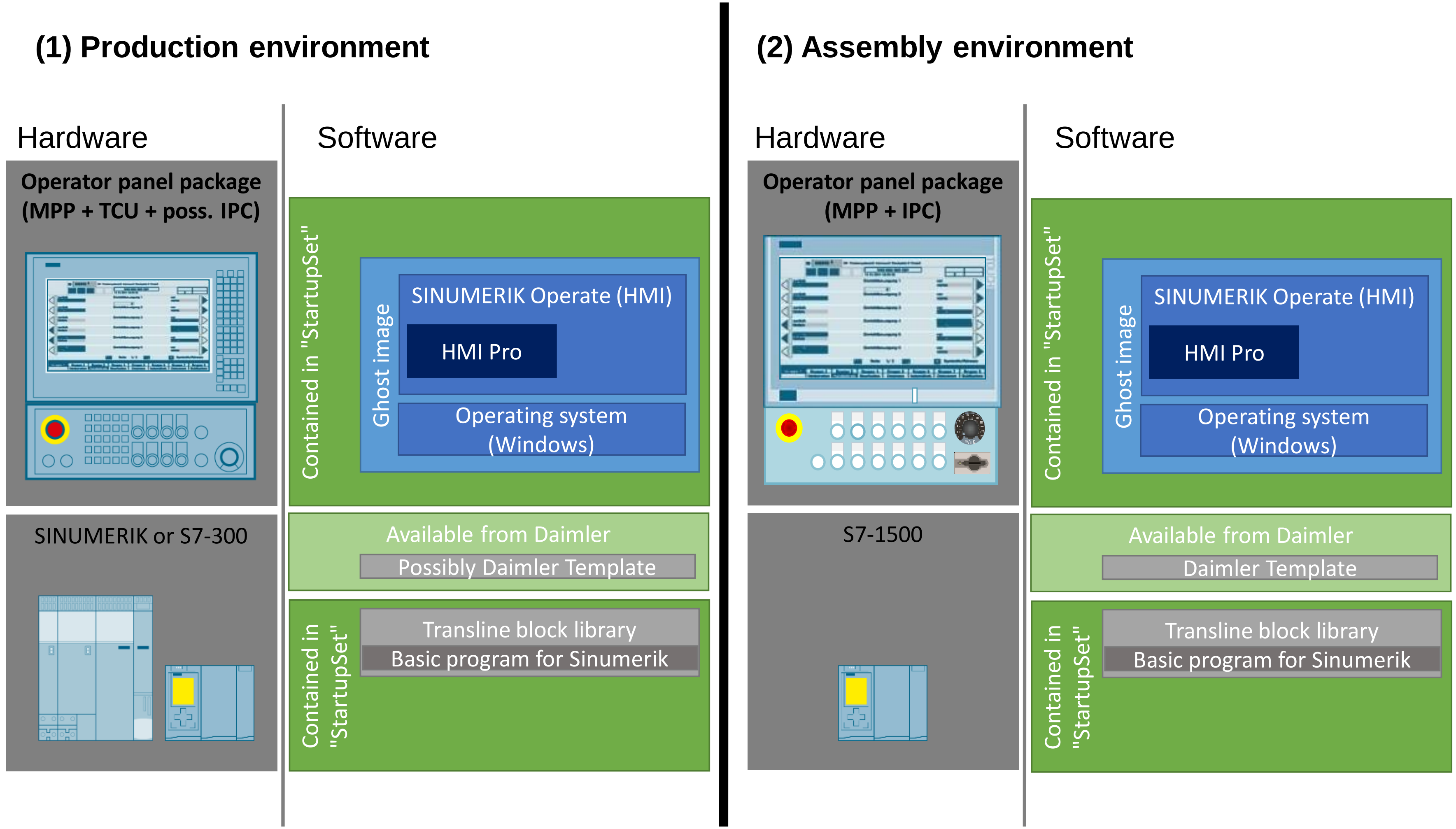


Fig. 1: Divisions of the "Transline" concept

The TRANSLINE concept consists of hardware that is tested together and coordinated as well as the matching software for the relevant components.

In the assembly environment, a S7-1500 is used (Fig. 1, right).

In the production environment, either a SINUMERIK control or a S7-1500 controller is used as the control hardware (Fig. 1, left). For S7-1500 applications, the separate document "Daimler Requirement Specification 2021 – Siemens Projectbook S7-1500" should be used.

Visualization for SINUMERIK is implemented with HMI Pro in Embedded HMI on the SINUMERIK or with the IPC 427. HMI Pro is always implemented on an IPC 427 in combination with the S7-1500.

In standard Powertrain projects, the plant network (machine network) is decoupled from the production network through a SCALANCE S component as the gateway between networks. The schematic structure is shown in Fig. 2.

3.1 Assembly

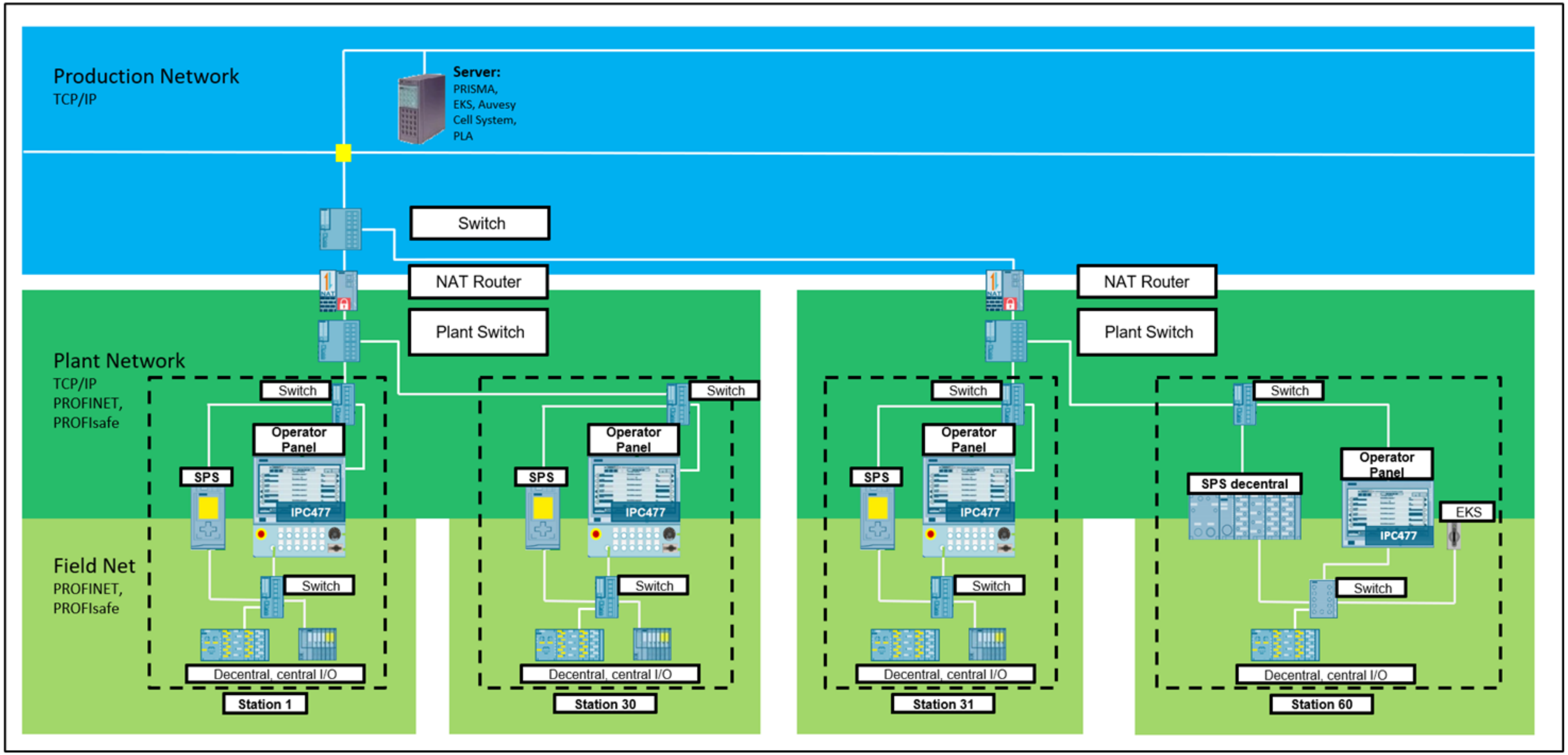


Fig. 2: Schematic diagram Transline concept Assembly

Note	Fig. 2 is a schematic diagram. The detailed concepts for the individual factories are to be found in the separate document "Daimler Networking Concept Assembly"

3.2 Production

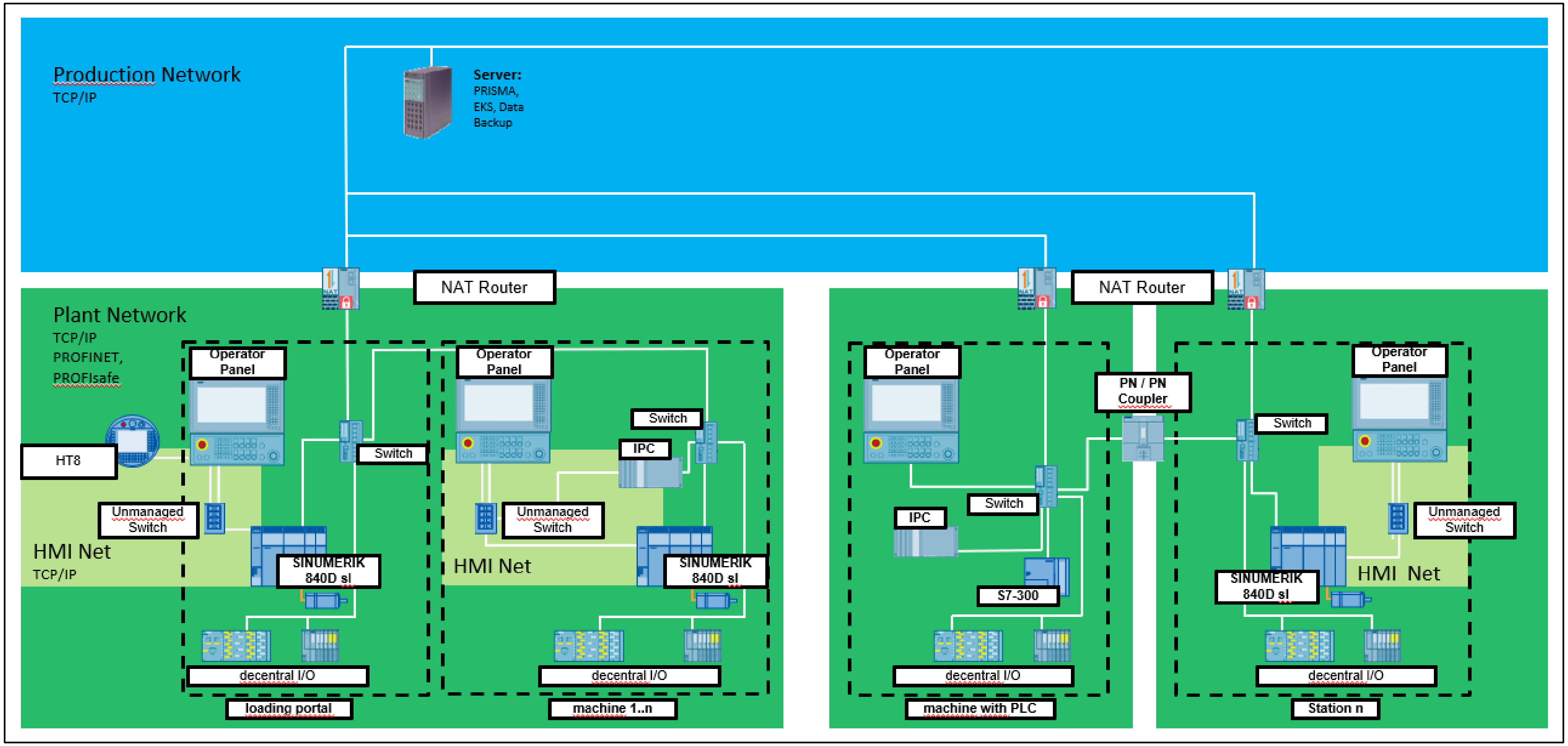


Fig. 3: Schematic diagram Transline concept Production

Note	Fig. 3 is a schematic diagram. The detailed concepts for the individual factories are to be found in the separate document "Daimler Networking Concept Production"

4 Control hardware

The following chapter provides an overview of the available Siemens components in the Powertrain environment. The components released for Mercedes Benz are listed in the Material Data Manager (MDM).

4.1 SINUMERIK 840D sl

The SINUMERIK 840D sl CNC offers modularity, openness, flexibility and uniform structures for operation, programming, and visualization. It provides a system platform with trend-setting functions for almost all technologies.

Integrated into the SINAMICS S120 drive system and complemented by the SIMATIC S7-300 automation system, the SINUMERIK 840D sl forms a complete digital system that is ideally suited to the mid- to upper-performance range.

The SINUMERIK 840D sl is characterized by:

- A high degree of flexibility
- Excellent dynamic response and precision
- Optimum integration into networks
- Outstanding performance and flexibility for multi-axis systems of mid to high complexity thanks to scalable hardware and software
- Universal openness of the user interface, the PLC and the NC area
- Integrated safety functions for man and machine: SINUMERIK Safety Integrated

Performance and flexibility

The scalability of the hardware and software – both in the CNC and the operating area – provides exceptional conditions for using SINUMERIK 840D sl in many sectors. The possibilities range from simple positioning tasks up to complex multi-axis systems. We offer different types of NCU for your machining tasks.

A total of 8 axes is provided by SINUMERIK 840D sl with NCU 710.3B PN, while the number of axes can be increased to a maximum of 31 in combination with the NCU 720.3B PN/NCU 730.3B PN. Up to 3 NCUs can be connected with the CBE30-2 communication module via NCU-Link. Thus, up to 93 CNC-controlled axes/spindles and 150 CNC and PLC-controlled axes/spindles can be implemented. Siemens has bundled its entire milling expertise into the SINUMERIK MDynamics technology packages. which allow users to attain outstanding milling results in terms of perfect surface quality, precision, quality and speed:

- Powerful CNC hardware and intelligent CNC functions
- Simple operation
- Unique CAD/CAM/CNC process chain
- Technological expertise in all industries

Use of an NCU 720.3B PN or NCU 730.3B PN is recommended where excellent dynamic response and accuracy are required for mold making applications or in the high-speed cutting (HSC) range.

	Notes	SINUMERIK 840DE sl/840D sl		
		NCU 710.3B PN	NCU 720.3B PN	NCU 730.3B PN
Axes/spindles, maximum configuration:	Option			
• CNC-controlled		8	31	31
• CNC and PLC-controlled		15	40	50
• PLC-controlled	Less the CNC-controlled axes/spindles	7 ... 15	9 ... 40	19 ... 50
Mode groups, maximum configuration	Option	4	10	10
Machining channels, maximum configuration	Option	4	10	10
Axes/spindles per channel, maximum configuration	Option	8	20	20
Interpolating axes, maximum configuration	Option: Multi-axis interpolation	8	20	20
CNC user memory:				
• Basic version		10 MB	10 MB	10 MB
• Maximum configuration	Option	16 MB	22 MB	22 MB
Block cycle times (block processing times), typical	Requirement: Use of the compressor	1.2 ms	0.5 ms	0.3 ms
DRIVE-CLiQ interfaces		4	6	6
SINAMICS NX10.3/NX15.3 modules, maximum configuration	NX10.3: up to 3 axes NX15.3: up to 6 axes	2 2	5 5	5 5

Table 1: Performance overview SINUMERIK 840D sl

4.2 Interface modules

Fig. 4: ET 200SP

The scalable SIMATIC ET 200SP I/O system is a highly flexible, modular and compact I/O system with IP20 degree of protection. Via an interface module with PROFINET interface, it can exchange the I/O data of the connected I/O modules with a higher-level control system.

Fig. 5: ET 200M

ET200M is a modular distributed I/O device in degree of protection IP20. It can be expanded with the signal, communication, and function modules of the S7-300 automation system.

Fig. 6: ET 200pro

SIMATIC ET 200pro is the modular I/O system with high IP65/66/67 degree of protection for local operation without control panel.

4.3 Operator panel packages

4.3.1 Machine control (user interface)

TRANSLINE (TL) HMI PRO should be deployed for the machine control. There are various operator panel packages for MB Powertrain. The contents of the operator panel packages for Daimler Powertrain are described in the material data manager (MDM).

Notice	Siemens points out the necessity of using an uninterruptible power supply (UPS) when using IPCs. Concerning this subject and the related specifications by Daimler, further information is available in the section "UPS Information" in the Siemens Daimler Extranet: https://support.industry.siemens.com/cs/ww/en/view/109765545

Note	A description of the current operator panel packages is provided in the Siemens Daimler Extranet: https://support.industry.siemens.com/cs/ww/en/view/109764862

Note	The operator panels are configured via the associated startup sets. Information about the associated sets is provided in the Siemens Daimler Extranet: https://support.industry.siemens.com/cs/ww/en/view/109764862

The operator panel package classes shown correspond to the definition valid at the time the requirement specification was issued.

Large operator panel manufacturing (GBF)

OP015 black with IPC 427

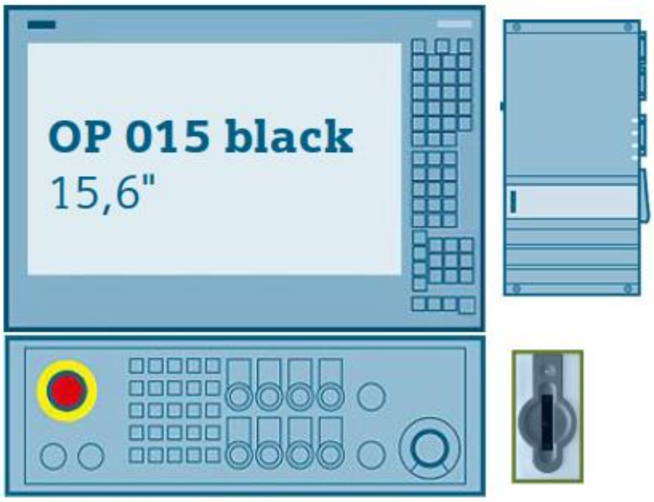


Fig. 7: GBF production

Medium-sized operator panel production (MBF)

OP015 black with embedded (MBF)

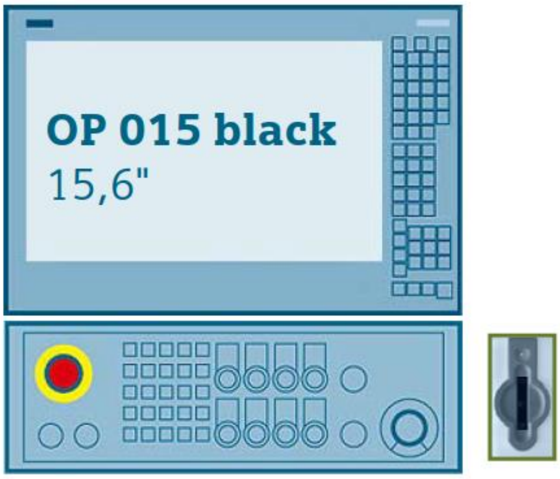


Fig. 8: MBF production OP015 with TCU

Mini operator panel TP700/TP1500 Comfort (KTBF-S7)

Note	Use of the TP700 / TP1500 operator panels is not generally approved and is only permitted after agreement in the Material Data Manager (MDM).

A TP700 or TP1500 Comfort Panel can only be used as an operator panel under the following conditions:

- No server connection (PRISMA, cell system, disable lists, etc.)
- No EKS
- No operating mode switchover
- No process diagnostics with S7 GRAPH required

Fig. 9: KTBF-S7 (TP 700)

Note	Hardware buttons must be implemented by the OEM. Subject to special approval by the relevant Daimler technical department, the KP8(F)-PN or KP32F-PN can be used.

The TP700 / KP700 panels must configured based on the current HMI Lite template.

Note	The SIMATIC Comfort Touch Panels must be operated with SIMATIC HMI memory cards.

4.3.2 Key assignment MPP483-IEH EKS

The key assignment for the MPP483-IEH was defined together with Daimler AG as follows:

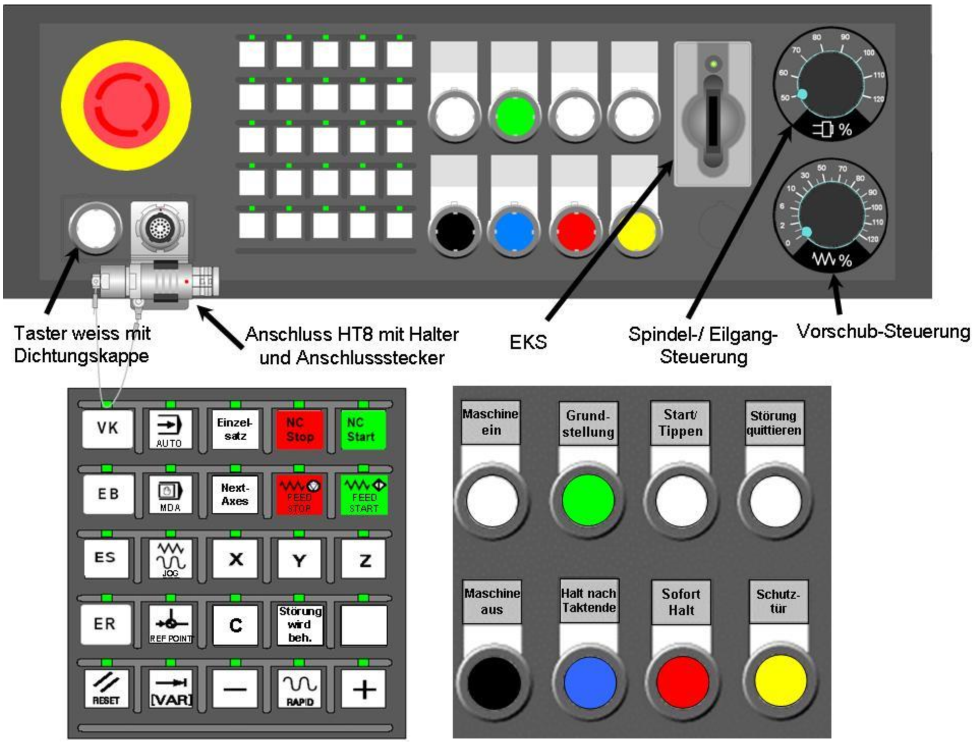


Fig. 10: Key assignment MPP483-IEH EKS S11 variant NC

The labeling of the MPP483-IEH identifies which of the functions must be used. Labeling strips are provided with each MPP483-IEH.

Note	The key functions have been redefined for the new operating modes defined in the Daimler Requirement Specifications, Part III Electrics, Appendix 32 "Operating modes". The templates for the labeling strips are available on the Siemens-Daimler Extranet.

Note	If more than four axes are required, the "Next axis" key opens the additional axis selection screen in the HMI Pro RT. See project DVD for documentation of the functionality and activation of the screen

4.3.3 SINUMERIK expansion panel 19"

The expansion panel is used in the manufacturing environment for the selection of the safe operating modes. The safe operating modes to be implemented must be agreed with the technical department of the Daimler AG.

MLFB no.: 6FC5247-0AA43-1AA0

Fig. 11: SINUMERIK expansion panel 19"

4.3.4 Functional scope of the operating panels

	NC		S7
	GBF	MBF	KTBF-S7
Hardware	OP015 black IPC 427 MPP483	OP015 black TCU MPP483	KP/TP700
Prisma connection	X	via NCU/PCU	
EKS w/ data base connection	X	via NCU/PCU	
multi place ethernet EKS	X	via NCU/PCU	
process diagnosis S7-Graph	X	via NCU/PCU	
side operation panel to GBF		X	
Transline HMI PRO Runtime	X	via NCU/PCU	
HMI Lite based on WinCC			X
HMI-WEB	not released	not released	not released
Usage of HT8 possible	X	X	

Table 2: Functional scope of the operating panels

Note	EKS without data connection is generally not permitted.

Note	The use of the KP/TP700 operator panels is not generally approved and is only permitted after the agreement (in the MDM = material data manager).

4.4 Handheld terminal (HT8)

Fig. 12: Handheld terminal 8

The HT 8 mobile handheld terminal combines the functions of an operator panel and a machine control panel in one device, Permitting complete operator control and monitoring of machines. It can be used according to the principle of a thin client (also see "Operator panels", Chapter: "Thin client unit") as a supplementary main operator panel or as a secondary control panel.

Specs

- Operator control via touch screen and membrane keys
- Fully graphic 7.5" TFT color display
- Emergency Stop button and two acknowledgment buttons for left-handed and right-handed operators
- Easy hot swapping during operation (hot plug and play), without triggering the emergency stop in combination with the PN Plus connection box and an additional, manual actuating element / keyswitch.

4.4.1 Interface modules

Variants

The connection box for the HT8 is available in three variants:

- PN Basic terminal box
  The PN Basic terminal box can be used if no hot-plug capability is required. The Emergency Stop circuit can be overridden here by external mechanisms.

- PN Plus terminal box
  The PN Plus terminal box features hot-plug capability. This means that disturbance-free hot-swapping is possible in operation. The Emergency Stop circuit is automatically maintained while switching over.
- PN Basic connection module
  The connection module Basic PN was specially developed for installation in the control cabinet. The terminating connector protrudes through the panel of the control cabinet so that the HT 8 can be connected from the outside.

4.5 SINUMERIK OP 015 black

Fig. 13: SINUMERIK OP 015 black

The SINUMERIK OP 015 black operator panel front with 15.6" LCD color display and 1366 × 768 pixels (widescreen format) enables the distributed installation of the operator panel front and the control. The SINUMERIK OP 015 black operator panel front has a capacitive keyboard with 64 keys and capacitive display area for gesture operation. The operator panel front is secured from the rear using special clamps. Installation is assisted by a self-holding mechanism. The clamps are included in the scope of supply.

Specs

- Convenient operation through capacitive sensor technology
- Efficient operation of larger machines using up to 4 additional, distributed operator panels simultaneously
- High-quality design and high degree of ruggedness
- Design of flat operator panels through shallow installation depth and low power loss.
- Vibration-free mounting of the SINUMERIK PCU (SIMATIC IPC for SINUMERIK) in the control cabinet

4.6 Startup sets

The startup sets are a software package provided for use by machine and plant manufacturers and plant operators. The set provides an image for the relevant operator panel system with which all Transline components are preinstalled. The set can be ordered as a product from Siemens. It is supplied as a bootable USB flash drive.

4.6.1 Content

Besides the image for straightforward commissioning and the associated commissioning software, the set also contains the following additional contents and adaptations.

- Installation files for HMI Pro CS and HMI Pro sl RT

- End-customer-specific adaptation of the network settings and firewall settings
- End-customer-specific HMI PRO project with adapted softkey assignment incl. documentation
- Additional end-customer-specific HMI images and documentation
- Latest version of the Transline libraries (S7-300 / S7-1500) incl. documentation
- Documentation for creating additional bootable USB flash drives

4.6.2 Release

The startup sets are released for projects in the Daimler environment through the MDM. The sets are matched to their operator panel packages in the Siemens Daimler Extranet:

https://support.industry.siemens.com/cs/ww/en/view/109764862

4.7 Ident devices – RFID

4.7.1 SIMATIC RF300

Fig. 14: SIMATIC RF300

The RFID system SIMATIC RF300 is particularly suitable for use in industrial production in the areas of production control, assembly lines and conveyors. SIMATIC RF300 is used to implement identification tasks with medium to high performance in the RF range (13.56 MHz). Depending on the performance of the identification system, two versions of the system are available:

- Medium performance: System configuration with SIMATIC RF300 readers in ISO 15963 mode and low-cost MOBY D transponders.
- High performance: System configuration with SIMATIC RF300 readers in RF300 mode and SIMATIC RF300 transponders.

The new generation of SIMATIC RF18xC/CI communication modules facilitates simple and secure connection of SIMATIC RF300 systems to cloud applications via an industrial IoT gateway, thus enhancing the range of potential uses for the data supplied by the RFID transponders.

Specs

- 13.56 MHz operating frequency
- For operating with ISO 15693 mode or RF300 mode

- Operation with MOBY E transponders (only with new generation of RF310R / RF340R / RF350R / RF380R readers)
- Passive (no battery), maintenance-free transponder (MDS Dxxx and RF3xxT) with memory up to 64 KB
- Rugged, compact components with IP67 / IP68 degree of protection
- Very high immunity to noise
- Extensive diagnostic functions
- Extremely fast data transmission
- Easy integration into SIMATIC, PROFINET, EtherNet/IP and TCP/IP.

4.7.2 SIMATIC RF200

Fig. 15: SIMATIC RF200

The SIMATIC RF200 RFID system is, thanks to its compact and low-cost reader, particularly suitable for use in industrial production in the areas of small assembly lines and intralogistics. With SIMATIC RF200, medium-performance identification tasks in the RF range (13.56 MHz, ISO 15693) can be implemented extremely cost effectively. SIMATIC RF200 readers can be operated with all ISO transponders.

Specs

- 13.56 MHz operating frequency (operation according to ISO 15693).
- Passive (without battery), maintenance-free transponders (MDS Dxxx) with memory capacities up to 8 KB FRAM.
- Rugged, compact components with IP67 degree of protection.
- Easy integration into SIMATIC, PROFINET and TCP/IP.
- Reader versions with RS422, RS232 or IO-Link

4.7.3 SIMATIC RF600

Fig. 16: SIMATIC RF600

With SIMATIC RF600, identification tasks are performed in the UHF range that demand a range of several meters. The system is suitable for storing and recording a unique identification according to the EPCglobal standard (Electronic Product Code) on products, containers or transport units. Storage of additional, freely-definable user data is also possible.

Various data carriers - from low-cost SmartLabels through to heat-resistant transponders that can be used for several thousand cycles - are available for industrial applications.

SIMATIC RF600 can be used with SIMATIC controllers, OPC UA clients, EtherNet/IP-based controllers and PC/IT systems. It can communicate data with cloud systems via an industrial IoT gateway.

Specs

- Transmission frequency
  - 865 … 868 MHz (ETSI)
  - 902 … 928 MHz (FCC)
  - 920 … 925 MHz (CMIIT)
  - 916 … 920 MHz and 920 … 924 MHz (ARIB)
- Range
  - Max. 8 m
- Protocol (air interface)
  - EPCglobal Class 1 Gen 2 V2
  - ISO 18000-62
  - ISO 18000-63
- Approvals
  - ETSI EN 302208, CE
  - FCC
  - UL
  - CMIIT

- Memory capacity
  - Max. 496 bits EPC, 3 424-byte user memory
- Data transfer rate for wireless transmission
  - Max. 300 kbps
- Multitag/Bulk capability
  - Yes
- Special features
  - SIMATIC or PC/IT integration
  - Configurable data processing in the readers
  - Special antennas for industrial applications
  - Powerful diagnostics functions

4.8 24V DC electronic power supply on the SINAMICS S120 booksize

For SINAMICS S120 converters in booksize design with modular configuration, the 24 V DC supply via Control Supply Modules (CSM) must be implemented for the NCU, NX and SINAMICS modules. These 24 V DC power supplies in booksize format switch their own supply to the converter DC link when a power failure occurs. In this way, power failures can be bridged and the electronics powered for a short time for specific retraction movements.

Note	A CSM can provide max. 20 A. It is possible to connect up to 10 CSMs in parallel. The CSMs and the measures for parallel connection are described in Manual 2 of the SINAMICS S120.

5 Network engineering

5.1 Network philosophy / Fundamentals

Up to 3 networks are used in the TRANSLINE environment.

Production / Factory network (Ethernet)

Connects the production plants to the IT landscape, such as PRISMA, cell system, EKS, and QDA.

Plant network (Ethernet and PROFINET)

By plant network, we mean the network in which PROFINET communication between the PLC and the PROFINET devices takes place and in which standard TCP communication is provided (e.g. quality data, master computer link) With this network, a SINUMERIK is connected both with the X150 interface and with the X130 interface. In control configurations comprising the S7-300, communication to the operator components is also provided via this network.

HMI network (Ethernet)

By HMI network, we mean the network between the HMI devices and a SINUMERIK 840D sl. Control configuration with S7-300 do not have this network.

5.2 Passwords

Within one plant, all logon data (USER, password) must be set identically on identical device types and agreed with the owner of the plant and provided to the owner after completion.

5.3 PROFINET Specifications

5.3.1 Plant 30 PROFINET Specifications

See Requirement specification "Plant 30 PROFINET Specifications".

5.3.2 PROFINET interface

Overview:

PROFINET devices of the SIMATIC product family have one or more PROFINET interfaces (Ethernet controller/interface). The PROFINET interfaces have one or more ports (physical connections).

PROFINET devices that have interfaces with multiple ports, also have an integrated switch.

PROFINET devices with two ports at one interface allow you to establish a system with a linear or ring topology. PROFINET devices with three and more ports at one interface are also suitable for establishing tree topologies.

Properties and rules for naming the PROFINET interface and its representation in STEP 7 are explained below.

Specs:

Each PROFINET device can be clearly identified in the network via its PROFINET interface. Each PROFINET interface has:

- A MAC address (factory setting)
- An IP address
- A PROFINET device name

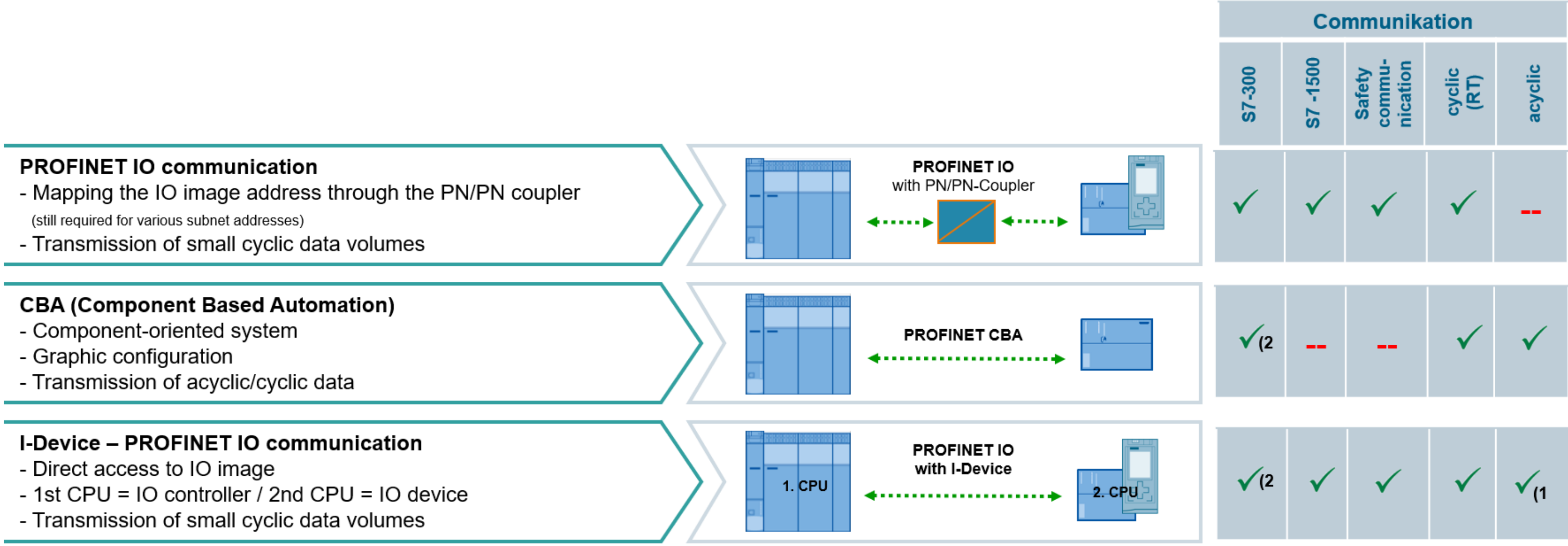
Options for assigning IP addresses and device names

Apart from the known address and device name allocation in the inspector window, Section "Ethernet addresses", there are other ways of assigning the IP address and a name:

- Assign, when loading the configuration to the target system via the "Extended load" dialog box
- Assignment via the Primary Setup Tool (PST)
- Assignment via PRONETA ("PROFINET network analysis") commissioning and diagnostics tool

Download Proneta: http://support.automation.siemens.com/US/view/en/67460624
Download PST: http://support.automation.siemens.com/US/view/en/19440762

5.3.3 Data transfer between controller and controller with PROFINET



(1 with Function blocks
(2 Note: CBA and I-Device cannot be combined with regard to the controller

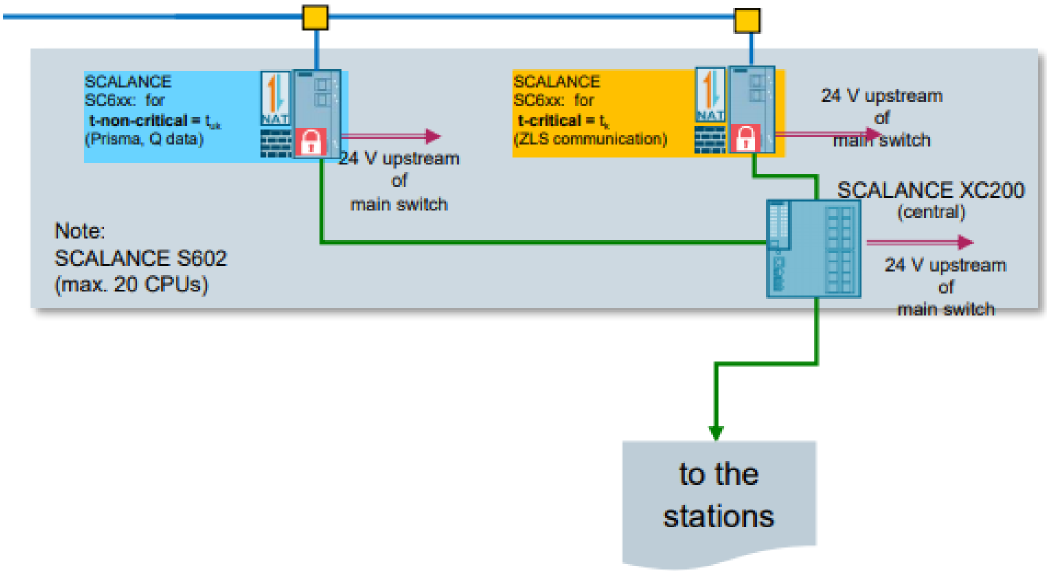
Fig. 17: Data transfer between controller and controller (standard)

Note	1. CBA and i-Device cannot be combined with regard to the controller. 2. Only with special release

5.4 Network Concepts

The application examples and associated IP addresses are provided in the separate documents about Daimler Networking Concepts for Assembly and production, which are also part of the Siemens Project Manual of the Daimler Requirement Specification 2021

5.5 Central transition into company network



Description Gateway SCALANCE SC6xx: non-time-critical (tnc)

The IP address of this SCALANCE $SC6xx_{tnc}$ is entered as the gateway for all components that perform non-time-critical communication in the higher-level factory network. These components continue to be included in the NAT table of this $SC6xx_{tnc}$, with which access "from outside" to these components is also possible.

Note that remote access, particularly during production, may affect the production depending on the access method. This applies particularly when generating large data volumes such as for a data backup or Ghost image.

If the $SC6xx_{tnc}$ is not available, all nodes must be implemented via the SCALANCE $SC6xx_{tc}$ via NAT.

Description Gateway SCALANCE SC6xx: time-critical (tc)

This SCALANCE $SC6xx_{tc}$ is entered as gateway only for components that perform time-critical communication in the higher-level factory network. Only these components are entered in the NAT table of this $SC6xx_{tc}$ so that higher-level communication is possible. Remote access during production should be avoided because a direct effect on the system cycle time of the plant cannot be excluded.

5.6 Names allocated to network nodes in the plant and field network

See Requirement Specification "Appendix 1 Names allocated to network nodes in the plant and field network"

5.7 Configuration of the devices

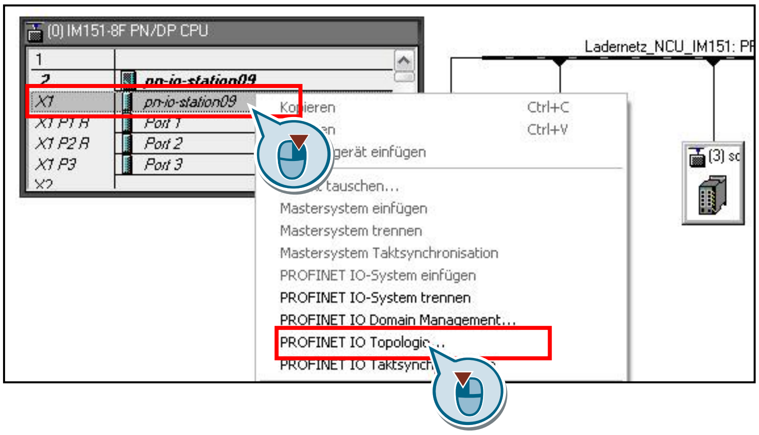
5.7.1 Interconnect ports in the topology view

Precondition:

You are in the graphical view of the hardware configuration of the station in question.

Procedure:

Integrating PROFINET components using the "Topology Editor" In the hardware configuration, right-click the Profinet interface, select "PROFINET IO Topology Editor".



Configuring the PROFINET topology:

Graphically connect the components via the ports as you would in a real plant.

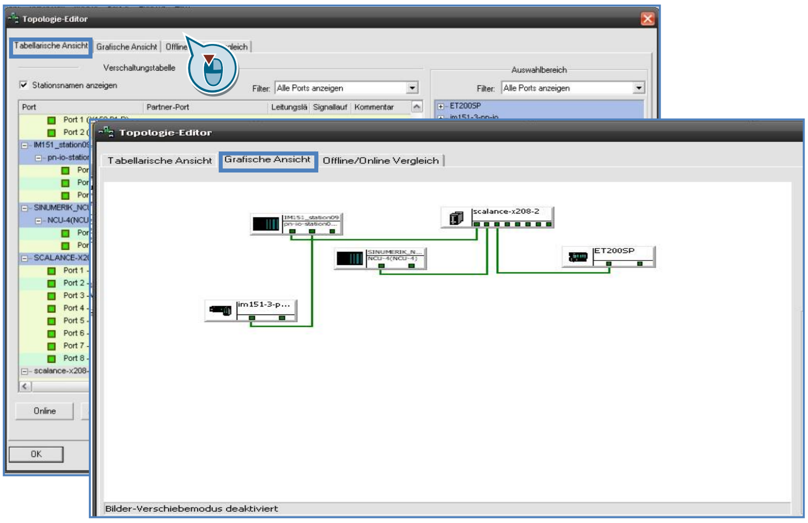


Fig. 18: Topology Editor

Note	For a SINUMERIK 840D, topological information can only be read out via the PN interface.

5.7.1.1 Interconnect ports in the topology view

Step 1: A IO device must be assigned to the IO controller

Precondition:

You are in the graphical view of the device configuration.

1. Place the mouse cursor on the interface of the IO device.
2. Click with the left mouse button and hold the button down.
3. Move the mouse cursor. The cursor now uses the networking symbol to indicate "Network" mode. At the same time, the cursor shows the lock symbol, which will only disappear when the cursor is on a valid target.
4. Now move the cursor onto the interface of the IO controller. You can either keep the mouse button pressed or release it.
5. Now release the left mouse button or press it again (depending on previous action).

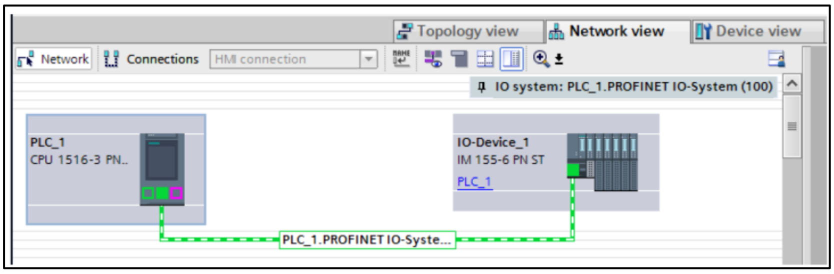


Fig. 19: Network view in the TIA Portal

Result: You have assigned an IO-Device to an IO-Controller.

Step 2: Interconnect ports in the topology view

Precondition:

You are in the graphical topology view of the corresponding station.

1. Proceed as follows to interconnect ports in the topology view:
2. Place the mouse cursor on the port to be interconnected.
3. Click with the left mouse button and hold the button down.
4. Move the mouse cursor. The cursor now uses the networking symbol to indicate "Interconnect" mode. At the same time, the cursor shows the lock symbol, which will only disappear when the cursor is on a valid target.
5. Now move the cursor onto the target port. You can either keep the mouse button pressed or release it.
6. Now release the left mouse button or press it again (depending on previous action).

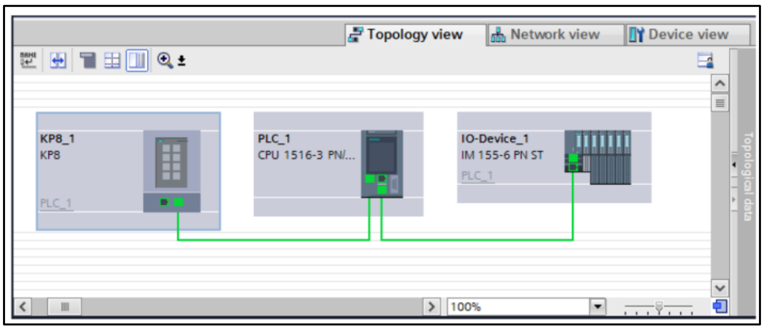


Fig. 20: Interconnect ports in the topology view

5.7.2 SCALANCE SC622-2

Classification in the documentation landscape:

The following description refers to the commissioning / configuration of the "SCALANCE-SC622-2C" security component for Daimler projects.

The description comprises the following steps:

- Initial commissioning
- Transfer of a basis configuration (to be provided by Daimler)
- Adjustment of the basis configuration

Configuration Manual:
https://support.industry.siemens.com/cs/ww/en/ps/15327/man

Function overview:

SCALANCE SC622-2C is suitable for use in supply disconnection in accordance with PROFIsafe in order to manage PROFIsafe addresses more easily.

The SCALANCE SC622-2C device does not have Layer 2 bridging functionality and thus forms a natural network boundary for PROFINET. This means it complies with the properties of a 2-port router in accordance with IEC 61784-3-3 (PROFIsafe)

The device is therefore suitable for use as cell protection device in safety environments in which it cannot be guaranteed that PROFIsafe addresses are unique.

Using a "C-PLUG":

The C-PLUG with order number 6GK1900-0AB10 must always be used to store the configuration + firmware on the C-Plug.

Note	• SCALANCE - S "DHCP Server Function": The function "DHCP Server" has not been released for all control constellations (NC control / PLC controller) in the plant network. A static IP address must always be set when integrating IPC or similar systems. • All parameters configured with Web Based Management (WBM) via http or HTTPS **As of TIA-PortalV15, the configuration can be performed via the TIA Portal, for which there is no recommendation in Powertrain projects.**

Note	**Configpack** The configuration of the device in Daimler context can be done using a configpack with the most important settings. It can be the foundation for all further settings. The configuration steps can be found in the attached documentation of the configpack. It can be found in the extranet: https://support.industry.siemens.com/cs/ww/de/view/109772255

5.7.3 SCALANCE XC2xx

5.7.3.1 Switch parameterization

Introduction:

The switches are parameterized with Web Based Management (WBM).

Wherever necessary, only the following parameter sets, which are monitored by the CPU (PROFINET controller), have to be adapted via the TIA Portal.

- Device name (PN name)
- Device type (MLFB)
- IP address
- Ring redundancy
- Port monitoring (100 Mbps full duplex)
- DCP settings
- LLDP settings
- Topology
- C-Plug error
- Redundant power supply

Ring redundancy setting

The "Ring redundancy" function is only required for a network with ring topology. This function is activated when the system is initially supplied / factory setting. For linear and star network topologies, this function must be deactivated. There are two ways of deactivating ring redundancy:

- via the hardware configuration of the TIA Portal
- via Web Based Management (WBM) using WEB browser. The procedure is described in the device-specific manual.

Do not configure via the TIA Portal in the Powertrain environment.

5.7.3.2 Integration in the engineering tool

The described configuration uses a SCALANCE XC2xx as example, and is a basic recommendation for operation in the network. This basic configuration can also be applied for other managed switches (SIEMENS) (see the equipment manual of the relevant SCALANCE switch).

Every managed switch should always be integrated in the hardware configuration. The switch is integrated into the TIA Portal just like a "PROFINET-IO component".

Using a "C-PLUG":

A C-PLUG must be used. This C-PLUG makes it possible to store the configuration + the associated firmware.

Required C-PLUG: Order no. **6GK1900-0AB10**

Precondition

You are in the graphical view of the hardware configuration of the station in question.

5.7.3.3 Switch integration into the hardware configuration:

Precondition

You are in the graphical view of the device configuration.

Step 1:

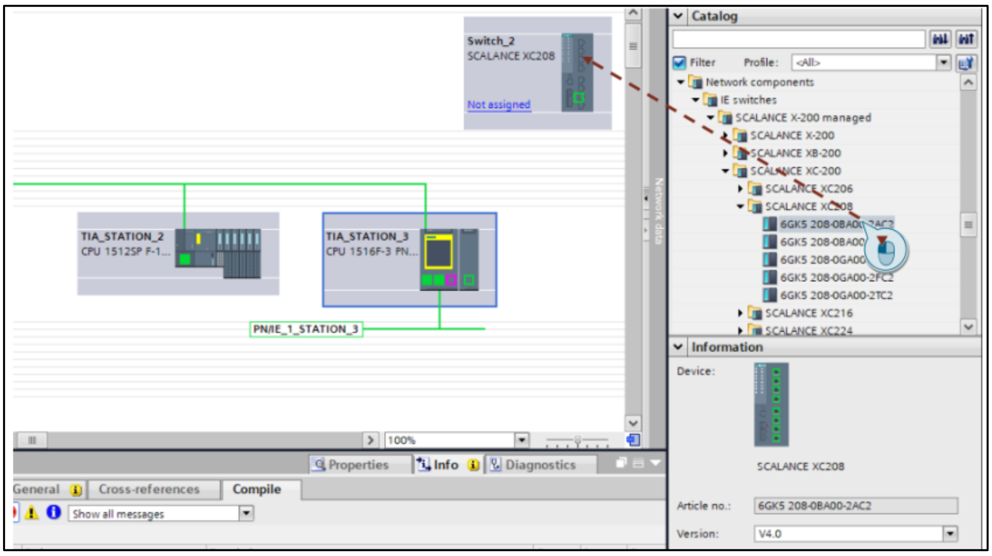


Fig. 21: Inserting a switch

Step 2: Switch must be assigned to the IO controller:

1. Place the mouse cursor on the interface of the switch.
2. Click with the left mouse button and hold the button down.
3. Move the mouse cursor. The cursor now uses the networking symbol to indicate "Network" mode. At the same time, the cursor shows the lock symbol, which will only disappear when the cursor is on a valid target.
4. Now move the cursor onto the interface of the IO controller. You can either keep the mouse button pressed or release it.
5. Now release the left mouse button or press it again (depending on previous action)

Result:

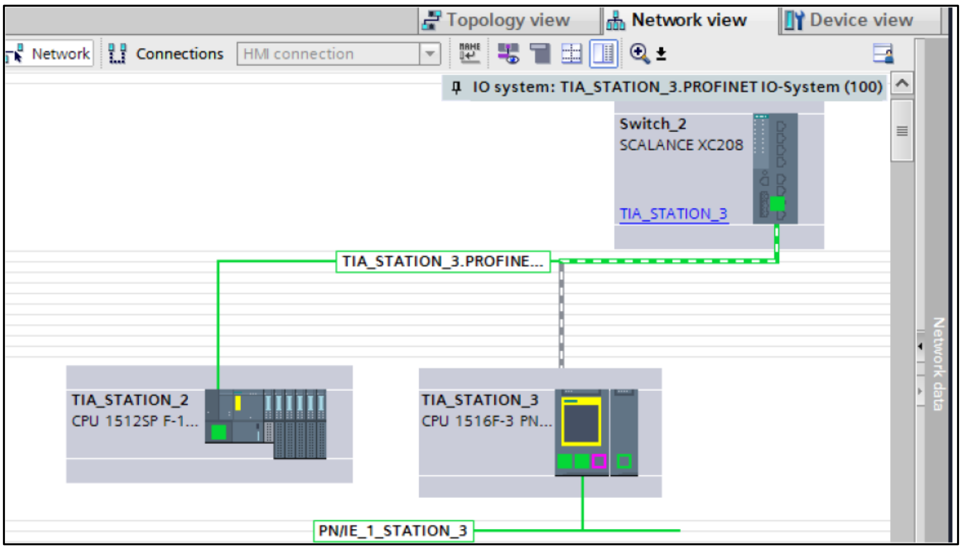


Fig. 22: Assignment to controllers

5.7.3.4 Set the ring redundancy

Precondition

You are in the graphical view of the device configuration.

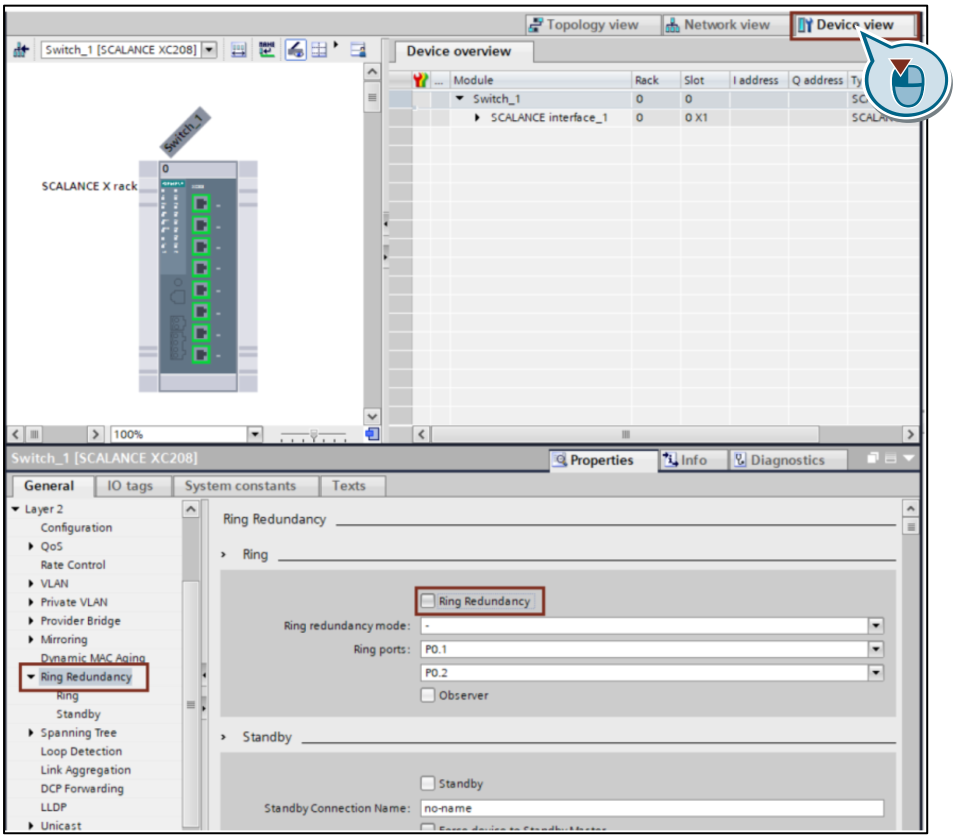


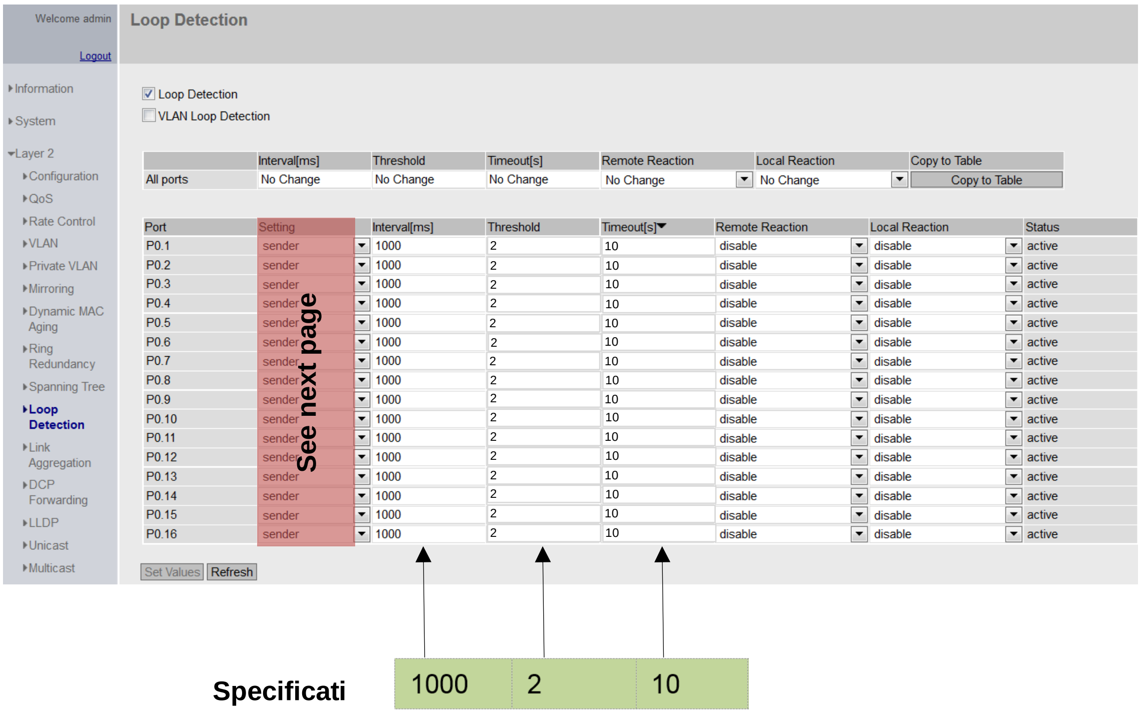
Fig. 23: "Ring redundancy" setting

5.7.3.5 Set the "Loop detection" function

Features:

Detects a loop or a port short-circuit (large broadcast) at the switch. Test telegrams are sent from the relevant ports. If these telegrams are sent back to the device, there is a loop.

Specification of loop parameterization threshold values:



	Interval[ms]	Threshold	Timeout[s]	Remote Reaction	Local Reaction	Copy to Table
All ports	No Change	No Change	No Change	No Change	No Change	Copy to Table

Port	Setting	Interval[ms]	Threshold	Timeout[s]	Remote Reaction	Local Reaction	Status
P0.1	sender	1000	2	10	disable	disable	active
P0.2	sender	1000	2	10	disable	disable	active
P0.3	sender	1000	2	10	disable	disable	active
P0.4	sender	1000	2	10	disable	disable	active
P0.5	sender	1000	2	10	disable	disable	active
P0.6	sender	1000	2	10	disable	disable	active
P0.7	sender	1000	2	10	disable	disable	active
P0.8	sender	1000	2	10	disable	disable	active
P0.9	sender	1000	2	10	disable	disable	active
P0.10	sender	1000	2	10	disable	disable	active
P0.11	sender	1000	2	10	disable	disable	active
P0.12	sender	1000	2	10	disable	disable	active
P0.13	sender	1000	2	10	disable	disable	active
P0.14	sender	1000	2	10	disable	disable	active
P0.15	sender	1000	2	10	disable	disable	active
P0.16	sender	1000	2	10	disable	disable	active

Note	In the standard setting, the loop error is automatically reset at the switch system (XC2xx). If the input field "Timeout" is set to value "0", the user must reset the loop via the WEB interface. A loop error can also be evaluated via the alarm contact F1/F2 on the XC2xx.

Specification Loop parameterization ports reference:

All ports are set to the function "SENDER" with the exception of the UPLINKs port toward the factory network (SCALANCE-S) or to other switches (see Robot example). All other ports are set to "FORWARDER" (default). Possibly coordinate with Daimler department "One M".

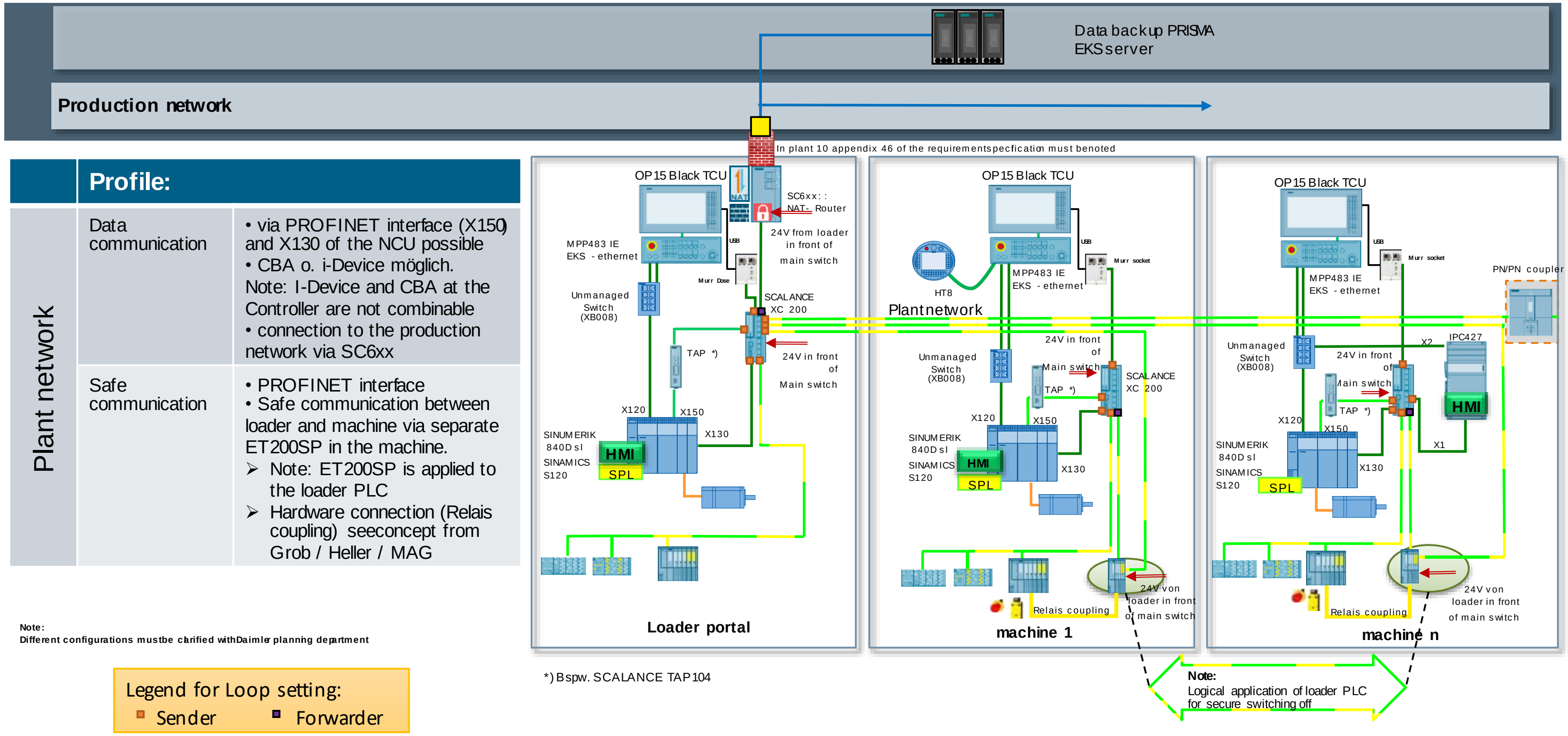


Fig. 24: Specification of loop parameterization

5.7.4 IPC 427

Introduction:

On the control system (SINUMERIK sl controls or IPC) used in combination with the Operate user interface, there are background services such as DNS and DHCP servers.

These services are required for operation of the HT8, TCU, or the EKS system. In particular the DHCP server must be prioritized in larger network topologies:

DHCP server priority assignment:	IPC	NCU
Priority 1	Master priority	ON_MASTER
Priority 2	---	ON_HIGH
Priority 3	Client sync.	ON_CLIENT_SYNC

Table 3: Overview of default DHCP server settings

5.7.4.1 DHCP server settings defined according to control configuration

IPC to NCU:		
DHCP server priority assignment:	**IPC**	**NCU**
Priority 1	--	--
Priority 2	--	ON_HIGH
Priority 3	– Client without sync. – Disable DHCP	--

Table 4: DHCP settings for IPC to NCU

TCU to NCU:		
DHCP server priority assignment:	**TCU**	**NCU**
Priority 1	--	--
Priority 2	--	ON_HIGH
Priority 3	--	--

Table 5: DHCP settings for TCU to NCU

IPC to S7-300:				
DHCP server priority assignment:	**1. IPC**	**2. IPC** Recommendation for single connection	**nth IPC**	**S7-300**
Priority 1	Master priority	--	--	--
Priority 2	--	High priority	--	--
Priority 3	--	--	– Client without sync. – Disable DHCP	--

Table 6: DHCP settings for IPC to S7-300

Basic requirements for parameterization of DHCP servers:

- if there are several SINUMERIK 840D sl control or IPCS in the same network segment
- all IPCs must have the same DHCP server range

5.7.4.2 SINUMERIK 840Dsl: Control configuration IPC with SINUMERIK Operate

Introduction:

The description refers to the constellation with multiple SINUMERIK 840D sl controls in conjunction with one IPC or one TCU operator panel.

When parameterizing the systems, for the operating concept, the system (SINUMERIK 840D sl control or IPC) on which the active Operate will actually be operated is decisive.

First option: "active Operate on the SINUMERIK 840D sl", then the network connection is directly parameterized from the SINUMERIK Operate user interface. Second option "active Operate on the IPC", in which case, the parameterization is implemented via the IPC and additionally on the SINUMERIK 840D sl using WINSCP Tool.

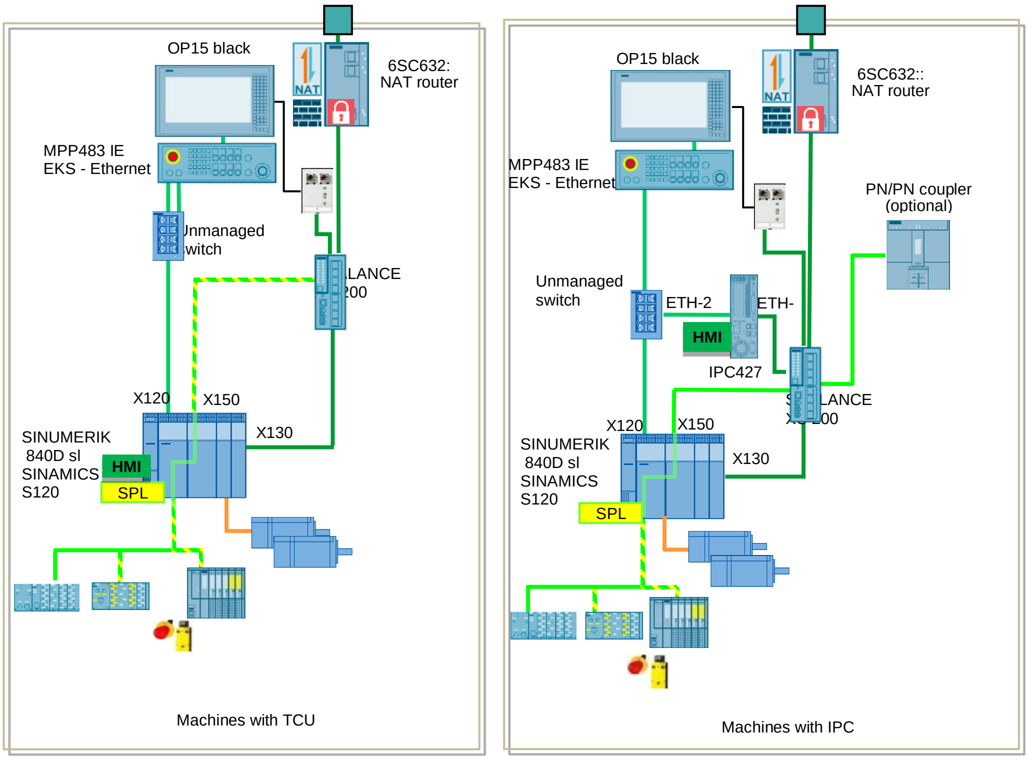


Fig. 25: Example configuration / layout (single machine)

<u>DHCP – server and server mode setting on the IPC:</u>

Step 1:

Boot the IPC in "desktop mode"

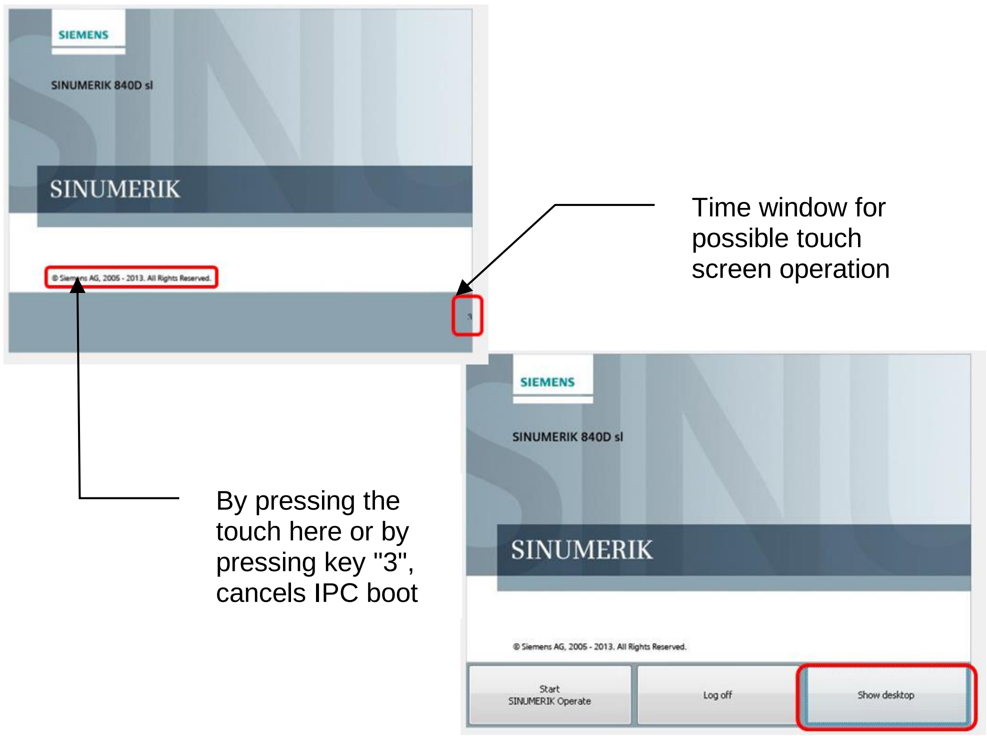


Fig. 26: Booting the IPC in "desktop mode"

Step 2:

Start SINUMERIK Operate from the desktop and follow the following menu navigation.

Commissioning ▶ Network ▶ Plant Network Settings ▶ DHCP

Step 3:

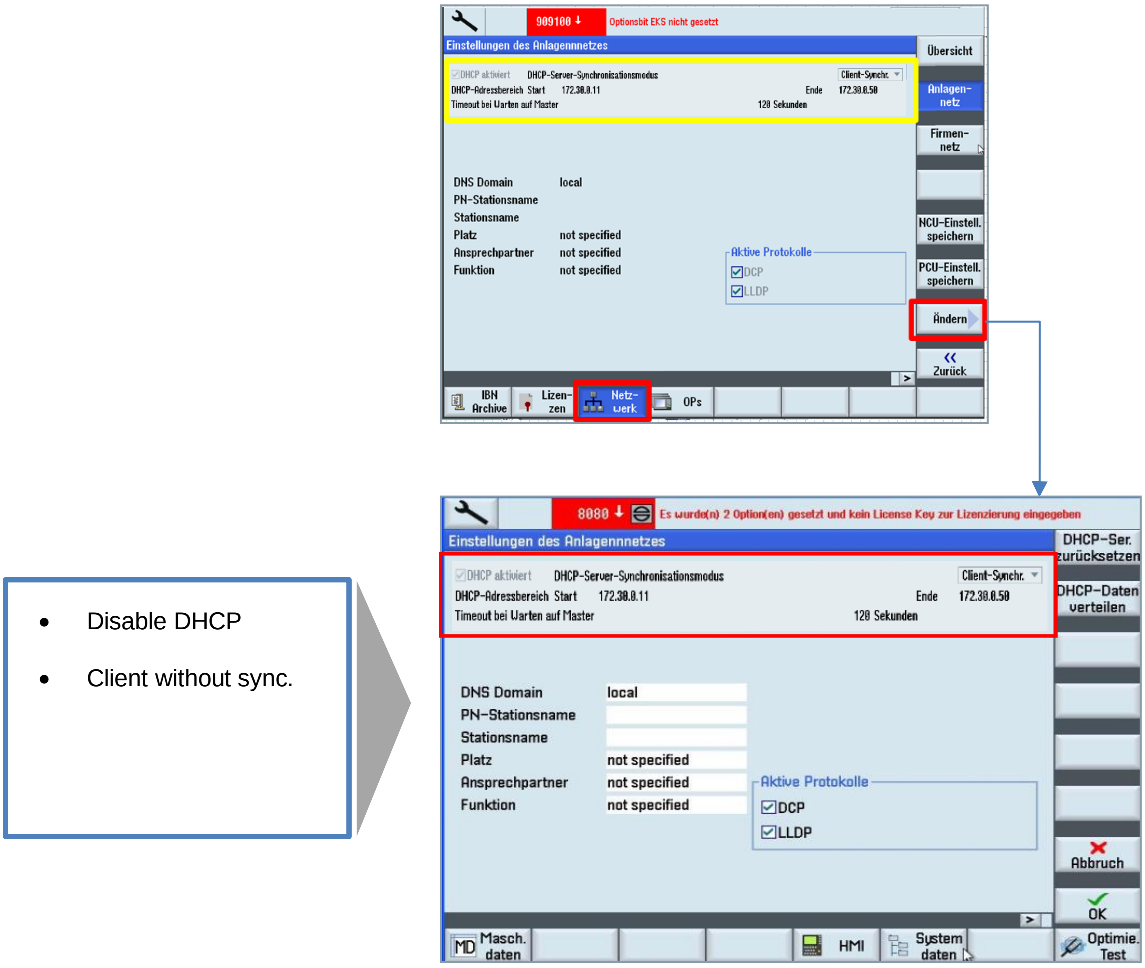


Fig. 27: DHCP server setting

Step 4:

Reboot IPC.

<u>Setting the DHCP server mode on the NCU</u>

Note	All of the following steps or settings are made using the WINSCP tool via interface X120 or X127. Knowledge of WINSCP is a requirement

Step 1:

Establish a connection to the NCU using the WINSCP tool.

Step 2:

Switch over to directory card/user/system/etc.

Step 3:

Open file basesys.ini and if necessary, adapt the entry.

```
; Set synchronization of all DHCP servers in the system/TCU network (X120).
; Possible values are:
; OFF,
; or ON_LOW (low priority),
; or ON or ON_HIGH (normal priority),
; or ON_MASTER (highest priority),
; or ON_CLIENT_SYNC (starts DHCP client only, synchronization active),
; or ON_CLIENT_NO_SYNC. (starts DHCP client only, synchronization in active),
; ON_MASTER is used to make this
; machine deterministically the DHCP master server, but should be used only
; for one server in the network.
SyncModeDHCPD_SysNet=ON
```

Fig. 28: Standard extract BASESYS.ini, set to ON ON_HIGH (normal priority)

Step 4:

Restart NCU and IPC.

5.7.4.3 SINUMERIK 840Dsl: Advanced settings and parameterization

Ethernet interfaces X130 interface

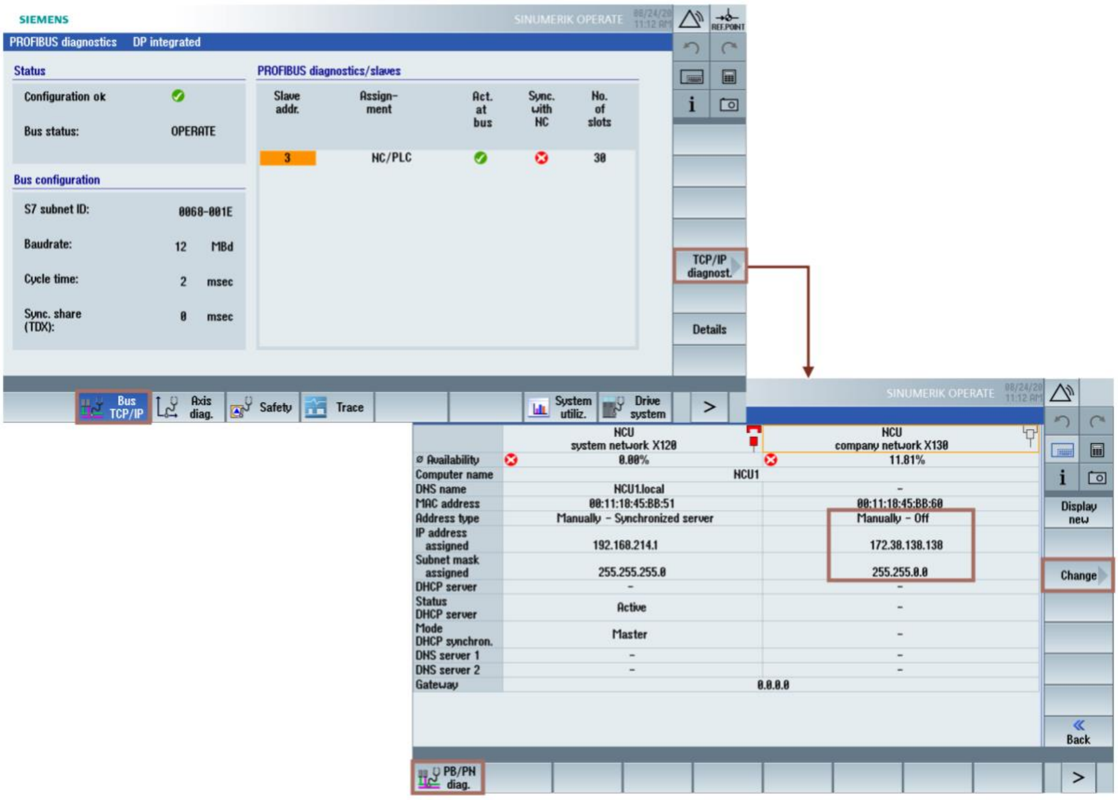


Fig. 29: Setting of the X130 interface

<u>When Operate is active on the IPC:</u>

The setting of the X130 interface when an IPC in connection with Operate is connected to the HMI network (no active HMI Operate on the NCU), the parameters are set using the WINSCP tool in the **Basesys.ini** file in directory: **card/user/system/etc**

Precondition: Knowledge of WINSCP

Extract from BASESYS.ini

```
; ----------------------------------------------------------------
; Default Linux base system configuration
; ----------------------------------------------------------------
;
; section ID is for Windows compatibility and is ignored

[ExternalInterface]
; If ExternalIP is set, you can force the external Ethernet
; Interface to use a static address, etc. instead of using DHCP.
; If a Hostname is set, it even overrides one received by DHCP.
;ExternalIP=210.210.210.210
;ExternalNetMask=255.255.255.0
;Gateway=210.210.210.1
;Nameservers=210.210.210.1 210.210.210.2
;Timeservers=210.210.210.3
;Hostname=somename
;Domain=example.com
```

Sample entries for one station

```
; ----------------------------------------------------------------
; Default Linux base system configuration
; ----------------------------------------------------------------
;
; section ID is for Windows compatibility and is ignored

[ExternalInterface]
; If ExternalIP is set, you can force the external Ethernet
; Interface to use a static address, etc. instead of using DHCP.
; If a Hostname is set, it even overrides one received by DHCP.
ExternalIP=172.30.1.6
ExternalNetMask=255.255.0.0
Gateway=172.30.0.1 => Gateway of S602 / 6SC632
;Nameservers=210.210.210.1 210.210.210.2
;Timeservers=210.210.210.3
;Hostname=somename
```

Integrating an MPP IE

For the connection to the NCU, the MPP IE must be set as SINUMERIK DHCP client. The addresses are set using switch S2 (addressing range 1...254). S9 and S10 must be set to off at DIP switch S2. The MPP IE is connected via Ethernet to the X120 Ethernet interface of the NCU (plant network).

5.7.5 HT8

5.7.5.1 SINUMERIK 840Dsl: Integrating the HT8

Introduction

The HT8 is connected via Ethernet to Ethernet interface X120 of the NCU (plant network) using the connection box or the MPP IE.

The address must be set at the two mini-rotary switches of the HT8 terminal box (addressing range 1..254) – and when the HT8 is first inserted. Address 14 is the default setting, i.e. S1=0 and S2=E.

General sequence

- Connect the HT8 to a connection module
- TCU settings
- Leave HT8 individual mode at NO
- Accept the TCU and MCP indices
- Leave Enable direct keys = No

In path /card/user/common/tcu/DIP14/common/tcu of the NCU, file "config.ini" must be supplemented by the following entries:

MaxHostIndex = 1

[DEFAULT]

[host_1]

Address = 192.168.214.241 ;address of IPC Eth2/X2

5.7.5.2 Switching over operator authorization between operator panel (IPC) and handheld unit (HT8)

Operator authorization switchover between the OP015 black and the hand-held terminal (HT8) when the protective door is open or closed (acknowledgment mode) is described below.

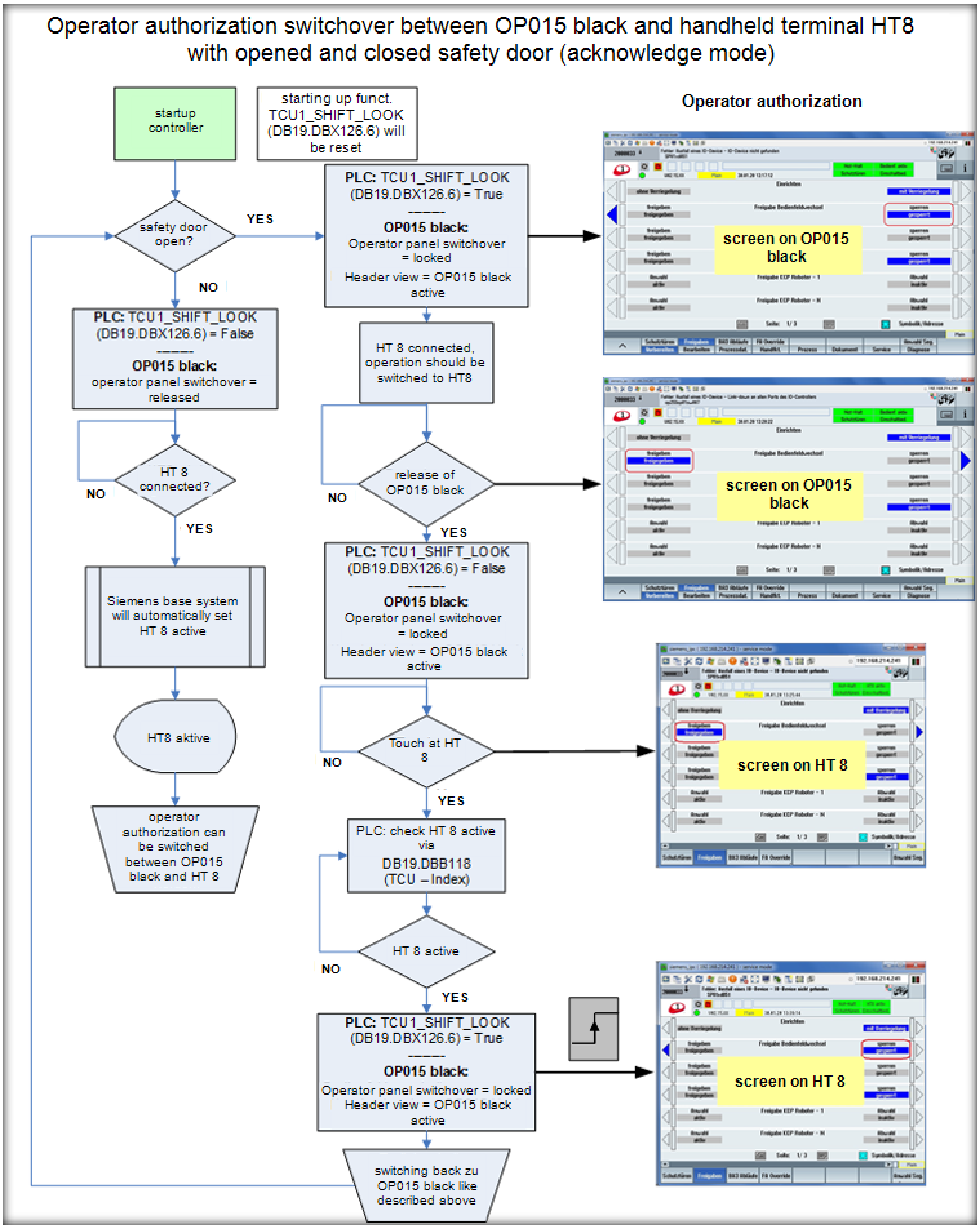


Fig. 30: HT8 operator authorization switchover

Note	• If an active HT8 is disconnected, operator authorization is always returned to the operator panel.

	• When the protective door is closed, the operator panel switchover interlock must not be active. • If several acknowledgment buttons are installed on one system, they must be mutually interlocked. See Powertrain Requirement Specifications, Part III Electrics, Appendix 2.

5.7.6 Engineering OP015 black

The OP015 black can be used as secondary operating panel for SINUMERIK machines. The configuration can be taken from the Extranet:

https://support.industry.siemens.com/cs/ww/en/view/109765545

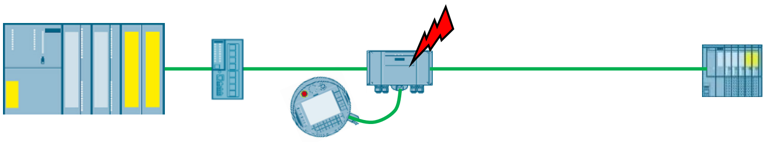
5.7.7 Constraints for operating the HT8 in a network topology

Problem description:

The 6AV6671-5AE11… terminal box does not support an LLDP protocol, which results in the line length being incorrectly displayed and a topology error being output.

When using network topologies in combination with the STEP 7 topology editor, be aware of the following constraints:

The Ethernet connection must not be looped through on the connection box.



Alternative 1: Application example with topology support at the end of network segment:

Alternative 2: Application example with topology support of a separate network segment:

5.7.8 MPP (Machine Push Panel)

General:

The MPP IE/PN is connected via the GSDML configuration. The MPP is operated as a standard PN node. For this, all S2 switches must be set to "ON".

The connection is made in the hardware configuration (like a standard PN module).

5.7.9 EKS

The Ethernet EKS must be set to DHCP mode. The following settings must be made on DIP switch S3:

S3.3 → OFF

S3.4 → ON

EKS configuration when DNS domain name is changed.

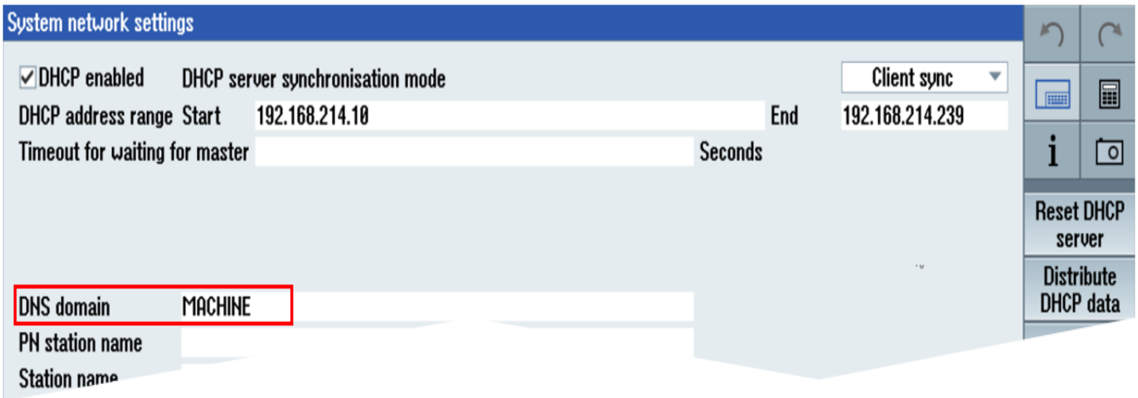


Fig. 31: Plant network when DNS domain name is changed

If the default DNS domain name (local) is changed under Commissioning ▶ Network ▶ Plant Network Settings ▶ DNS Domain, the following actions must be performed:

- The files under ...user/services/udhcpd/var/lib/misc udhcpd-eth*.* must be deleted.
- The IPC must be booted twice.
- LTLP_ChangeDomainName must be called in OB100 in order to acquaint the control with the new DNS domain name.
- The EKS configuration in HMI PRO CS must be performed as follows:
  - In field Default EKS Module, append the altered DNS domain name to the EKS name using a dot (.).
  - If exactly one EKS exists, no further assignment must be configured.

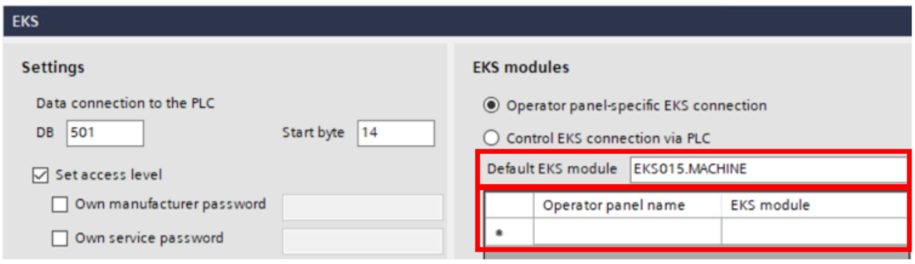


Fig. 32: EKS configuration in HMI PRO CS when DNS name is altered

Multiple EKS in one HMI Pro screen

For example, if multiple control stations with operator panel switchover and multiple EKS are planned for a single control, in each case the valid EKS modules are assigned to the corresponding plug-in points in the HMI Pro CS.

One and the same EKS can be assigned to multiple control stations (see EKS001 -> SIEMENS_IPC and DIP13).

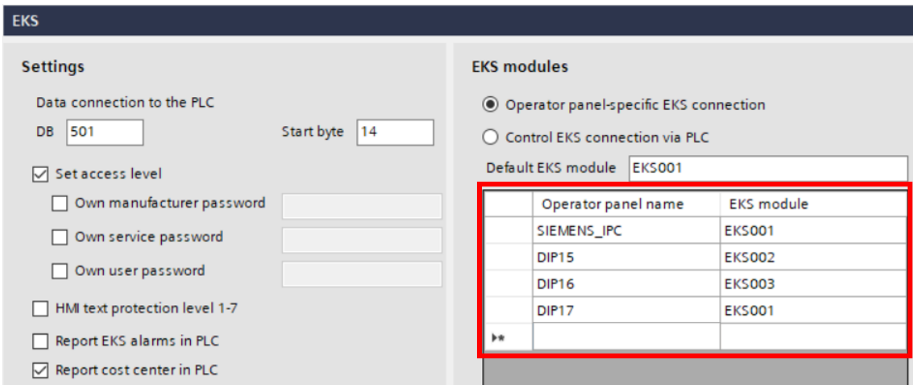


Fig. 33: EKS assignment in HMI PRO CS for multiple EKS on one CPU

Note	To complete a full configuration of the EKS screen, please find further details in the help of the HMI Pro CS.

5.7.10 MV500

The MV500 is positioned in the plant network via the PROFINET interface in accordance with the network concept (Fig. 34)

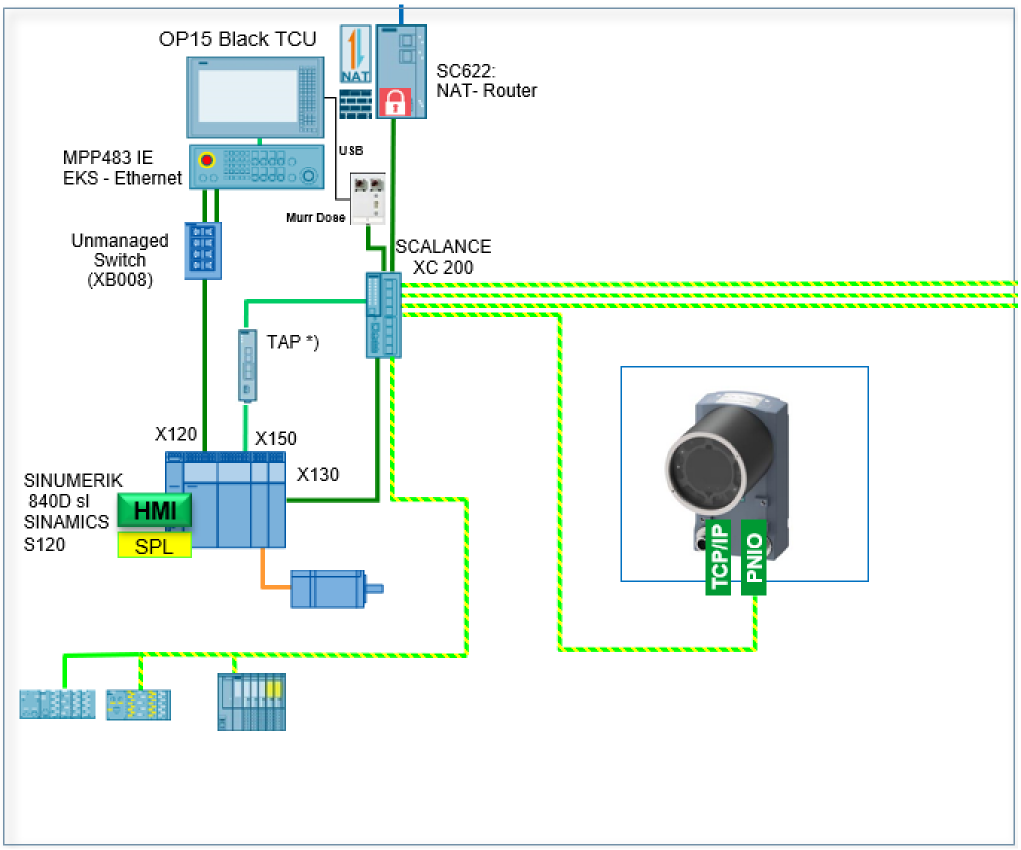


Fig. 34: Example of integration of a SIMATIC MV500

Note	The SIMATIC MV550 and the MV560 are equipped with a second Gbit Ethernet interface. This can be optionally used to transfer images and quality information with

	high performance through the plant network to the higher-level systems. The PROFINET connection to the PLC is still implemented via the PN interface.

5.7.10.1 Requirements

The following preconditions must be met for commissioning:

- CPU: DualCore with 3 GHz
- RAM: 4 GB
- Operating system: Microsoft Windows 7 operating system or newer
- .NET Framework V4.0
- Web browser (tested web browser: Microsoft Internet Explorer as of V11 and Google Chrome as of V57)
- Recommended screen resolution: 1920 × 1080
- Network connection via Ethernet TCP/IP
- Primary Setup Tool (PST)

  You will find the Primary Setup Tool (PST) in your SIMATIC installation or as a free download on the pages of the Siemens Industry Online Support (https://support.industry.siemens.com/cs/ww/en/view/19440762).

Notice	**Possible faults when operating as a DHCP/DNS server** Note that the optical reader is set up as a DHCP/DNS server when a connection is established via the "CONNECT" button. This may interfere with communication in an existing network. Another DHCP/DNS server in the network must not be enabled. If the IP address of the reader is changed after the connection has been established, the connection is broken. In addition, the "CONNECT" function is deactivated. This function can be enabled again via the "Settings > Options > Extras" menu.

5.7.10.2 Connecting and setting up the reader using the PST

Step 1: Connect the reader and PC using an Ethernet cable

Connect the reader directly to your PC/programming device over an Ethernet cable.

Step 2: Switch on the optical reader

Disconnect the power supply of the optical reader. The optical reader is supplied with power either via a connected CM cable or via the Power IO RS232 cable or PoE cable. You will find more information on connecting the device in the operating instructions of the camera in Chapter "Connection" (https://support.industry.siemens.com/cs/ww/en/view/109768126). Note that a self-test is performed each time the optical reader is started. The self-test is indicated by the power LED flashing and lasts from a few seconds to 2 minutes. Once the test is completed, the power LED lights up in constant green and the optical reader is ready.

Step 3: Configure the Ethernet connection between reader and PC

To configure the Ethernet connection between the reader ("X1 LAN1" interface) and the PC, follow these steps:

1. Start SINEC PNI.

2. In the "Settings" menu, select the "network adapter" via which the reader is connected to the PC.
3. Make sure that the "Scan protocol > PROFINET devices" is activated

Note	Note that the function "Fetch additional information" can take some time when the network includes many devices.

4. Click the "Save" button.
5. Switch to the "Device list" menu.
6. Click on the "Start network scan" button in the toolbar.
   Reaction: The network is scanned for connected devices and all recognized devices are displayed in the device list.
7. Select the desired reader in the device list.
8. Click on the "Configure device" button in the toolbar.
   Reaction: The "Device configuration" window opens.
9. Enter a new, unique IP address for the reader in the "IP address" input box.
10. Enter the subnet mask of your network in the "Subnet mask" input box.
11. Switch to the "PROFINET" tab.
12. Enter a device name in the "PROFINET device name" input box.
13. Click the "Load" symbol to transfer the settings to the reader.
    Result: The reader is assigned the new IP address, subnet mask, and a new device name.

Note	**Restart may be required** Depending on the mode being used, you may need to restart the reader by turning the power off and on again.

Note	**Ethernet connection via the "X2 LAN2" interface** Note that you can only establish a connection to the optical reader via the "X1 LAN1" Ethernet interface using the Primary Setup Tool. You can configure the "X2 LAN2" Ethernet interface via the WBM "Settings > Communication > Interface > Ethernet" or using a DHCP server.

Device flash test

If several readers are connected to the network/PC, it is possible to make the LK LEDs of the device selected in the output window flash. Using the device flash test, you can identify the required reader quickly and simply.

Follow the steps below to identify the relevant reader using the flash test:

1. Select the desired module from the device list in the "Device list" menu.
2. Click on the "Flash LED" button in the toolbar.
   Reaction: The LK LED flashes at a frequency of 1 Hz (1 s) on the selected reader.
3. Click the "Stop" button to stop the flashing.

Step 4: Start Web Based Management (WBM)

Proceed as follows to start the WBM:

1. Start your web browser.

2. Enter the IP address of the reader in the address bar of your browser.
3. Confirm your entry by pressing the <Enter> key.
   Response: The upstream setup page of the WBM opens.
4. Click "Start page".
   Response: The WBM of the reader opens.

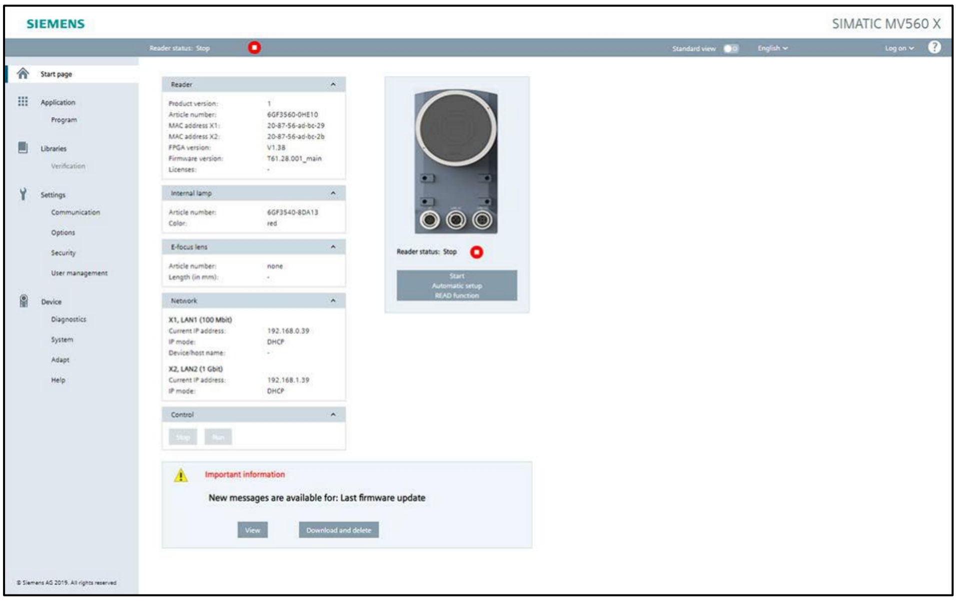


Fig. 35: Start page of the WBM of the MV500

Step 5: Align the optical reader

Before you put the optical reader into productive operation, you must first align it correctly and configure it. To do this, use the "Auto-setup" function in the "Application > Program" menu. In the image display, the image section is displayed as the optical reader sees it.

Also note the information on installing the reader in the manual, Chapter "Mounting" (https://support.industry.siemens.com/cs/ww/en/view/109768126).

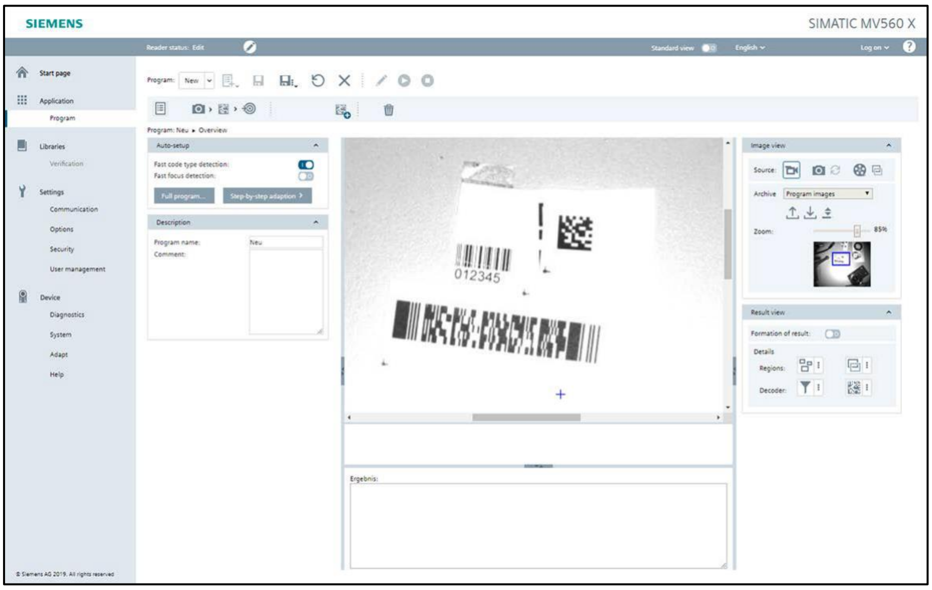


Fig. 36: The "Overview" program step in the "Program" menu of the WBM

Note	**Focus image** Depending on the lens used, the image must be focused manually. When using a mini-lens, you may need to loosen the fixing screws on the lens and then use the knurled screw to focus the image. If an EF lens is used, the focus setting is performed automatically by the "Auto-setup" function.

Note	**Always perform the alignment without the protective lens barrel** The orientation and basic configuration of the optical reader should always be performed without a screw-on protective lens barrel.

To align and configure the reader, follow these steps:

1. Position the optical reader so that the code to be read appears in the center of the image and is focused sharply.
2. Click the "Full program" button to automatically generate a basic configuration of all relevant parameters for simple reading tasks.
If necessary, you can also restart individual steps in the "Auto-setup" group, or you can set individual parameters manually in the WBM.

Note	**Automatic exposure** If the parameter "Exposure = Auto" is set, the code must be completely in the image after the triggering until the automatic exposure is completed (approximate value: 50 ms).

3. Check the read result by enabling the "Formation of result" parameter in the "Result view" group ("Application > Program").
4. Save the settings using the "Save program" or "Save program as" button.
5. The optical reader has been commissioned successfully. Then you can read codes for your application, make special settings and save them under individual programs.

Note	**Access online help with the "?" button** In the WBM, you can use the "?" button at the top right to access the online help at any time. The online help opens with the context-sensitive help text relating to your current task.

Operating the optical reader in PROFINET mode ("X1 LAN1")

In PROFINET mode, you can do the following with the optical reader:

- Connect to the PC or the PG in your existing PROFINET IO network.
- Integrate as a device in a PROFINET IO network.
- Integrate as a device in a PROFINET IO network with an existing IP address (can be set in the configuration software).
- Assign the IP configuration of the PROFINET IO controller.

Notice	**Setting the IP address for "X2 LAN2"** Note that you can only set the IP address for the "X2 LAN2" interface via the WBM.

Notice	**Ethernet interfaces in different subnets** Note that you must operate the Ethernet interfaces "X1 LAN1" and "X2 LAN2" in two different subnets. If you do not comply, you cannot save the changes in the WBM, or if you use PST, the IP address of the "X2 LAN2" interface is discarded.

5.7.10.3 Performing automatic adaption

EasyStart

The function EasyStart offers fully automatic parameterization of the MV500 based on live image alignment. The program name can be defined. This function can be used after a hardware replacement or for recommissioning.

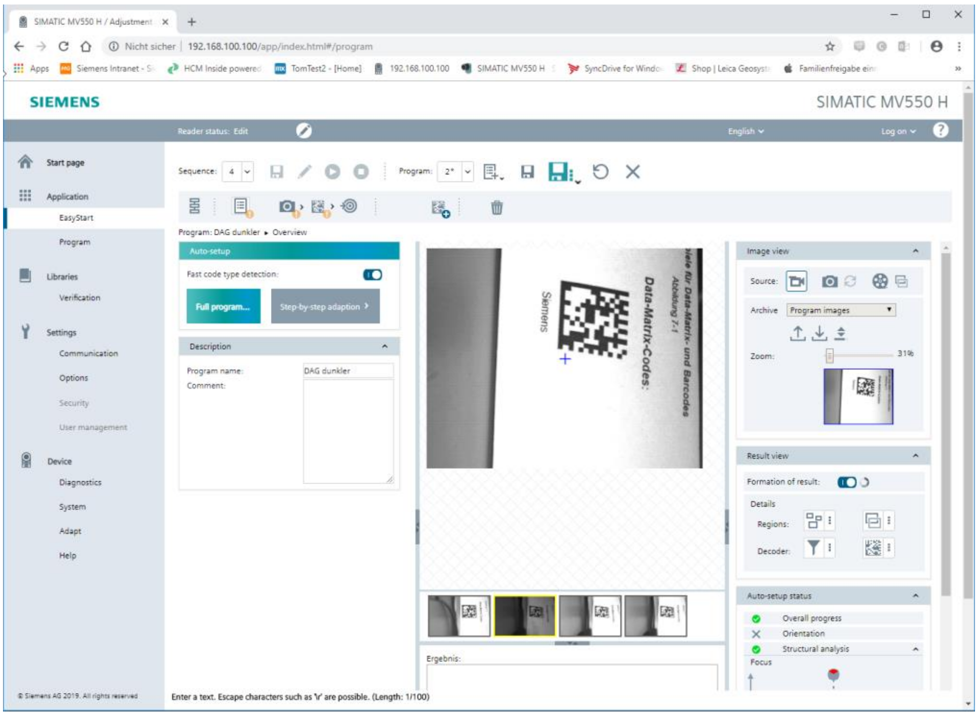


Fig. 37: MV550 – EasyStart

Automatic adaptation using the "READ" button

With the "READ" button, you can align the optical reader and automatically adapt all relevant program settings. This function basically corresponds to the function "Full program" of the WBM.

Requirements:

- To use the function, you need a code in the target area of the reader.
- The WBM of the reader is closed.

Description of functions:

The first time you press the "READ" button, the reader changes to "Adaption" status and an "Alignment" LED lights up. You can optimally align the reader to its target range with the help of the LED.

If the "READ" button is pressed again, the reader automatically optimizes the camera settings for the prevailing ambient conditions. You can find detailed information on this function in the "Auto Setup" section of the online help. The process can take up to five minutes depending on the model version and the code used. During this process, the "READ" LED flashes green.

When the process has been completed successfully, the "READ" LED lights up in green for 5 seconds. If the process could not be completed, the "READ" LED lights up red for 5 seconds. After the adaption has been successfully completed, the settings are saved in the specified target program. Finally, the reader returns to processing mode ("Start").

If errors occur during the process, they are indicated by a yellow or red flashing "READ" LED. Detailed information on the errors is provided in Chapter "Service and maintenance" of the manual (https://support.industry.siemens.com/cs/ww/en/view/109768126).

You will find additional information about the functions and settings of the "READ" button in the online help in Chapter > "Settings > Options > Extras".

Aborting automatic adaptation:

You can cancel running automatic adaption in the following way:

- With open WBM: by pressing the "Cancel" button in the progress bar, by a page change or by closing the WBM.
- With closed WBM: by pressing the "READ" button again. Note that during the first adaptation step, the "Alignment", pressing the "READ" button signals the completion of the alignment to the reader.

Additional function of the "READ" button:

When the "Program" page of the reader's WBM is open, you can press the "READ" button to switch result generation on or off.

Automatic adaption with the help of the "Full program" function

As an alternative to the "READ" button, you can perform the adaption via the WBM using the function "Full program" in the menu "Application > Program > Overview > Auto-setup".

However, the "Full program" function differs in the following aspects from adaptation using the "READ" button:

- No "Align" LED is switched on, because alignment can be performed via the image display of the WBM.
- The adaption progress is displayed in the "Auto-setup status" area.
- When adaption is complete, the reader automatically switches to edit mode ("Edit").
- Once the adaption is completed, the changes must be manually saved in the desired target program.

You can find detailed information on this function in the "Application > Program > Overview > Auto-Setup" section of the online help.

5.8 PROFINET Specifications

5.8.1 Plant 30 PROFINET Specifications

See Requirement specification "Plant 30 PROFINET Specifications".

5.8.2 Data transfer between controller and controller with PROFINET

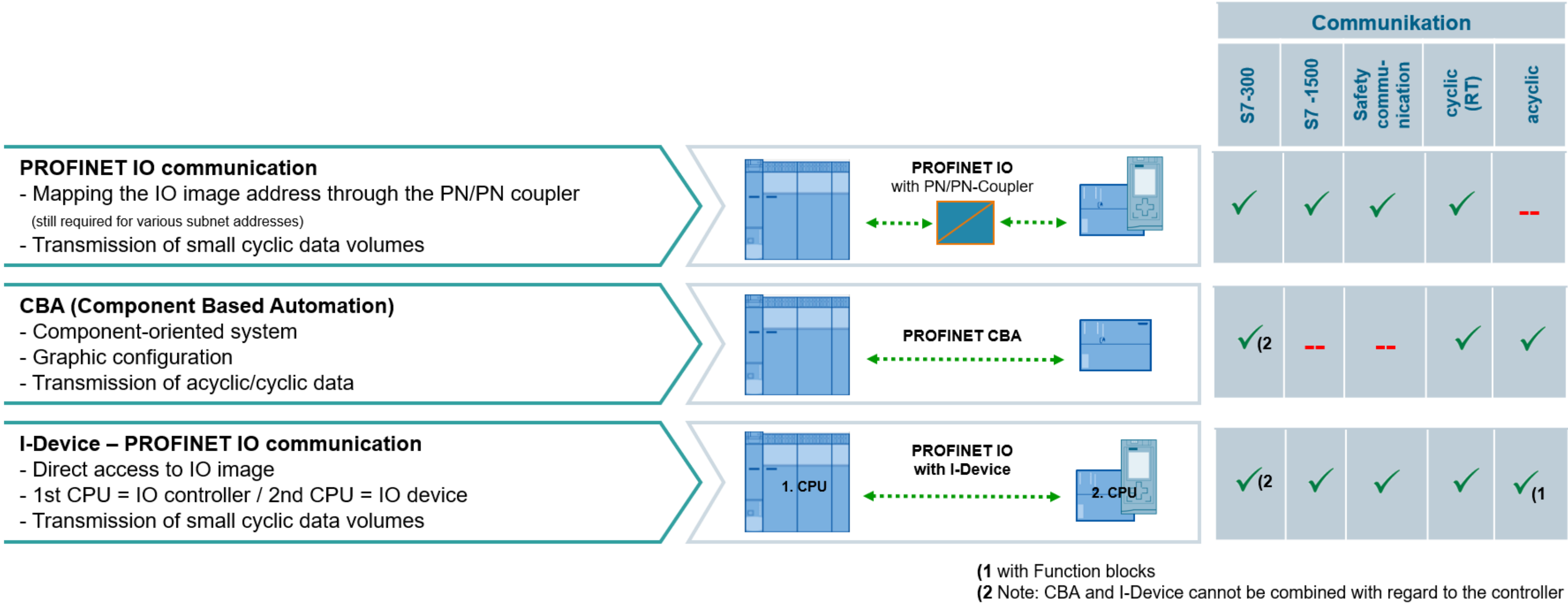


Fig. 38: Data transfer between controller and controller (standard)

Note	3. CBA and i-Device cannot be combined with regard to the controller. 4. Only with special release

5.8.3 PROFINET interface

Overview:

PROFINET devices of the SIMATIC product family have one or more PROFINET interfaces (Ethernet controller/interface). The PROFINET interfaces have one or more ports (physical connections).

PROFINET devices that have interfaces with multiple ports, also have an integrated switch.

PROFINET devices with two ports at one interface allow you to establish a system with a linear or ring topology. PROFINET devices with three and more ports at one interface are also suitable for establishing tree topologies.

Properties and rules for naming the PROFINET interface and its representation in STEP 7 are explained below.

Features:

Each PROFINET device can be clearly identified in the network via its PROFINET interface. Each PROFINET interface has:

- A MAC address (factory setting)
- An IP address
- A PROFINET device name

Options for assigning IP addresses and device names

Apart from the known address and device name allocation in the inspector window, Section "Ethernet addresses", there are other ways of assigning the IP address and a name:

- Assign, when loading the configuration to the target system via the "Extended load" dialog box
- Assignment via the Primary Setup Tool (PST)
- Assignment via PRONETA ("PROFINET network analysis") commissioning and diagnostics tool

Download Proneta: http://support.automation.siemens.com/US/view/en/67460624
Download PST: http://support.automation.siemens.com/US/view/en/19440762

6 Controller programming

6.1 General specifications

6.1.1 Programming tools

The programming tools to be used are described in the Powertrain Requirement Specifications, Part III Electrics/ Appendices/Appendix 10 "Product partner overview".

The valid software versions are listed in the overview in the Powertrain StartUp Sets (successor to the project DVDs)

Note	All systems must be programmed with S7 GRAPH!

6.2 Explanation of terms

Performance

The performance of an automation system refers to the processing time (cycle time) of a program.

If reference is made to a performance loss, this means it would be possible to reduce the processing time, and therefore the cycle time of a program sequence, by applying the programming rules and through skillful programming of the user program.

Identifier / name

It is important that a distinction is made between names and identifiers. The name is a part of an identifier that describes the applicable meaning.

The identifier comprises …

Prefix

Name

Suffix

Abbreviations

The following abbreviations are used within this text:

Abbr.	Type
OB	Organization block
FB	Function Block
FC	Function
DB	Data block
TO	Technology object

Table 7: Abbreviations for blocks

Terms for tags and parameters

Where tags, functions and function blocks are concerned, there are many terms that continue to be used in different capacities, or even incorrectly. The following illustration clarifies these terms.

Term	Explanation
Tag	Tags are designated by a name/identifier and occupy an address in the memory in the controller. Tags are always defined with a specific data type (bool, integer, etc.): PLC tags Individual tags in data blocks Complete data blocks
Tag value	Tag values are values that are stored in a tag (e.g. 15 as a value of an integer tag)
Actual parameters	Actual parameters are tags that are interconnected at the interfaces by statements, functions, and function blocks.
Formal parameters (transfer parameters, block parameters)	Formal parameters are the interface parameters of statements, functions, and function blocks (Input, Output, InOut and Ret_Val).

Table 8: Terms for tags and parameters

6.3 PLC programming

6.3.1 General restrictions

For PLC outputs, there must only be one network with write access for all program blocks.

PLC outputs must be implemented in the conventional program section (not Graph step sequences).

The blocks of the basic PLC program are only available in English. These should be used together with the blocks of the German TRANSLINE block library and the Daimler block library.

6.3.2 Organization blocks (OB)

Blocks OB121 and OB122 are exclusively to be used when commissioning the system. After commissioning (start-up) has been completed, these blocks must be removed from the control.

In operation, OB121 suppresses program errors and OB122 I/O errors so that faults/errors such as these cannot be diagnosed.

If it should be necessary to deactivate or activate I/O modules during operation, then the OB122 must be present in the control system.

6.3.3 Daimler maintenance test blocks

Test blocks to be called for DAIMLER maintenance.

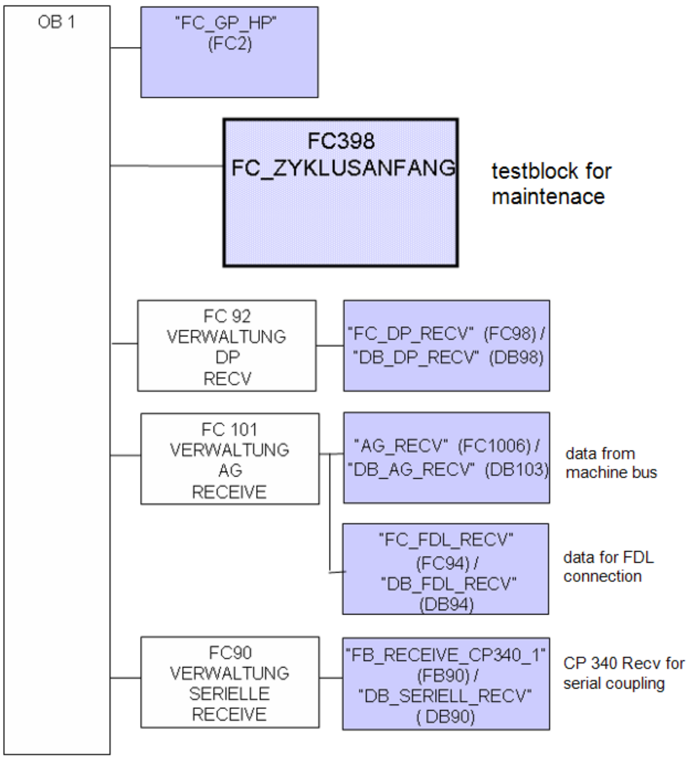


Fig. 39: Call of Daimler maintenance test blocks

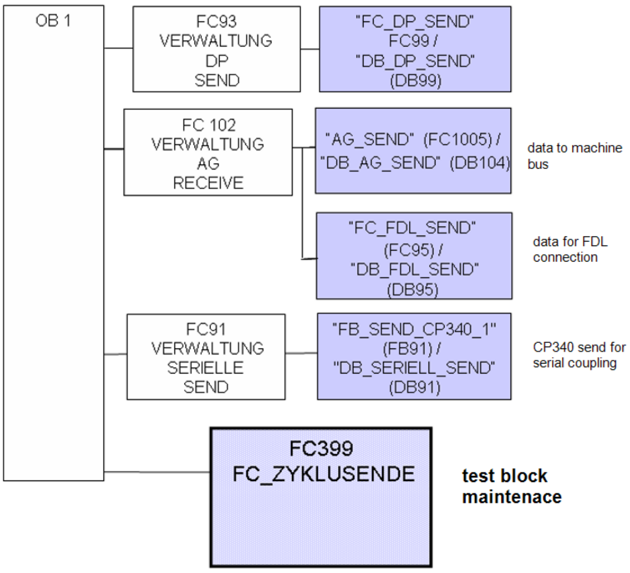


Fig. 40: Call of Daimler maintenance test blocks

6.3.4 Use of a fault data block DBxxx

If a fault data block, which was defined in the HMI PRO project under the "Faults" area, is used in addition to the DB2 or only the configured fault data block for displaying the PLC error messages from 700000 is used, then the associated alarm number must be recognizable via the variable name.

Adresse	Name	Typ	Anfangswert	Kommentar
0.0		STRUCT		
+180.0	A7000xx	ARRAY[0..63]		Alarm 700000-700063 (Anwenderbereich 0)
*0.1		BOOL		
+188.0	A7001xx	ARRAY[0..63]		Alarm 700100-700163 (Anwenderbereich 1)
*0.1		BOOL		

Fig. 41: Fault data block variable name DB2/126

6.3.5 Symbols of the global interface DBs for NC systems

For the global interface DBs created by the basic program, the assignment in the data type field for the respective available UDT must be configured in the symbols table.

27		DB_SIEM_SIN_ALAR...	DB	2	UDT	2	
28		DB_SIEM_NCK	DB	10	UDT	10	Interface NC
29		DB_SIEM_MMC	DB	19	UDT	19	Interface MMC-Signals
30		DB_SIEM_KANAL_1	DB	21	UDT	21	PLC-Grundprogramm840D
31		DB_SIEM_KANAL_2	DB	22	UDT	21	PLC-Grundprogramm840D
32		DB_SIEM_ACHS_SPI_1	DB	31	UDT	31	PLC-Grundprogramm840D
33		DB_SIEM_ACHS_SPI_2	DB	32	UDT	31	PLC-Grundprogramm840D
34		DB_SIEM_ACHS_SPI_3	DB	33	UDT	31	PLC-Grundprogramm840D
35		DB_SIEM_ACHS_SPI_4	DB	34	UDT	31	PLC-Grundprogramm840D
36		DB_SIEM_ACHS_SPI_5	DB	35	UDT	31	PLC-Grundprogramm840D
37		DB_SIEM_ACHS_SPI_6	DB	36	UDT	31	PLC-Grundprogramm840D
38		DB_SIEM_ACHS_SPI_7	DB	37	UDT	31	PLC-Grundprogramm840D

Fig. 42: Table of symbols

6.4 Transline library

6.4.1 General information

The block numbers and block timers listed below should remain the same in all TRANSLINE Solutions for Powertrain projects.

There are eight different types of block:

Type 1: SIEMENS standard blocks

Type 2: TRANSLINE-specific standard blocks

Type 3: Project-specific blocks

Type 4: TRANSLINE-specific prototype blocks

Type 5: Project-specific prototype blocks

Type 6: Application-specific blocks

Type 7: Reserved function-related blocks

Type 8: HMI Lite TRANSLINE-specific blocks

Type 1, 2, 3 and 8 blocks may not be modified by machine manufacturers. Prototype blocks of the types 4 and 5 are used by machine manufacturers and adapted to the conditions of their machines. Application-specific blocks of the type 6 are created by machine manufacturers, thus determining their function. A range of numbers is reserved for a defined function for type 7 PLC blocks. The structure and content of the blocks are defined by machine manufacturers.

Product-specific SIEMENS standard blocks of the type 1 and accompanying documentation are purchased through SIEMENS sales partners; type 2, 3, 4, and 5 blocks are supplied by machine manufacturers.

All blocks designated as Free for user assignment are available for special functions of machine manufacturers. Special end customer blocks should be stored in the Free for end user assignment area.

Description	DB	FB	FC
PLC basic program	DB1-29	FB1-29	FC1-29
NC functions (840D, 611U) user, axes	DB31-58	FB30-58	FC30-56
Manager blocks and operator panel	DB59-66	FB59-66	FC57-66
HMI Lite	DB67-69	FB67-69	FC67-69
S7 GRAPH standard blocks	---	---	FC70-73
Tool Manager (SIEMENS)	DB71-80	FB71-80	FC74-80
Special modules identification system 1	DB81-84	FB81-84	FC81-84
Safety Integrated	DB85-89	FB85-89	FC85-89
Communications, CP340, DP, FDL, diagnostics	DB90-105	FB90-105	FC90-104
HMI Lite	DB106-109	FB106-109	FC105-109
NC (mode group, HPU, HHU, Safety)	DB110-120	FB110-120	FC110-120
NC functions, user, channel, etc.	DB121-130	FB121-130	FC121-130
Tool monitoring / measuring equipment	DB131-139	FB131-139	FC131-139
Management and control, nut runner	DB140-149	FB140-149	FC140-149
HMI supply	DB150-159	FB150-159	FC150-159
Free for user assignment (machine manufacturers) When using S7 Distributed Safety, the F-application blocks are saved in this area	DB160-400	FB160-400	FC160-400
Reserved for HMI PRO	DB401-460	FB401-460	FC401-460
Reserved for HMI Lite	DB461-480	FB461-480	FC461-480
Free for end customer assignment	DB481-600	FB481-600	FC481-600
Free for user assignment (machine manufacturers)	DB601-999	FB601-999	FC601-999
Reserved by Siemens for SINUMERIK	DB1000-1099	FB1000-1099	FC1000-1004
Free for user assignment (machine manufacturers)	DB1100-max	FB1100-max	FC1100-max

Table 9: Overview of TRANSLINE block structure

6.4.1.1 Mandatory data blocks when using HMI PRO

The following data blocks are essential when using HMI PRO:

DB_NCK (DB10)

This DB is found in the Toolbox when using an NC, or in the TRANSLINE Library when using a
SIMATIC PLC.

DB_MMC (DB19)

This DB is found in the Toolbox when using an NC, or in the TRANSLINE Library when using a
SIMATIC PLC.

DB_HMI (DB59)

This DB is found in the TRANSLINE library. It can also be stored in the control with a different number. For HMI PRO RT in the HMI PRO CS configuration tool, this must be entered in the project navigation under Configurations ▶ Default settings ▶ Control via PLC ▶ User-defined standard DB.

6.4.1.2 Generally useful information

Forming general bit memories for TRANSLINE

```
L    #OB1_SCAN_1
L    1
==I
=    "m_restart"

SET
R    "m_zero"
S    "m_one"
S    "m_startup"
S    "m_construct"
```

Memory byte 1 in the SIMATIC/SINUMERIK hardware catalog is generally set as the clock memory.

When using SINUMERIK, you must not use the following TRANSLINE Library blocks:

UDT_NCK	UDT10	Interface NCK
UDT_MMC	UDT19	Interface MMC
UDT_FBM	UDT2	Interface for alarm/operational messages
FC_RUN_UP_S7	FC1	
FB_RUN	FB1	
DB_SYSTEM2	DB4	PLC messages

DB_SYSTEM1	DB3	PLC messages
DB_SIN_ALARM_SERVER	DB2	Interface for alarm/operational messages
DB_NCK	DB10	Interface NC
MMC	DB19	Interface MMC signals

Note	When an NCU is being used, these blocks must be accepted by the SINUMERIK basic program!

6.4.2 Block list

6.4.2.1 Organization blocks (OB)

Standard OB	Project-specific OB	Symbol name	Description	840D sl	S7-300	Type
OB1	OB1	OB_CYCLIC	Cyclic processing	X	X	6
OB10	OB10	OB_TIME1	Time-of-day interrupt	X	X	7
OB11	OB11	OB_TIME2	Time-of-day interrupt		X	7
OB20	OB20	OB_DELAY1	Time-delay interrupt	X	X	7
OB21	OB21	OB_DELAY2	Time-delay interrupt		X	7
OB32	OB32	OB_CYCLIC_INT1	Cyclic interrupt		X	7
OB35	OB35	OB_CYCLIC_INT2	Cyclic interrupt	X	X	7
OB40	OB40	OB_PROCESS_INT1	Hardware interrupt	X	X	6
OB41	OB41	OB_PROCESS_INT 2	Hardware interrupt		X	7
OB80	OB80	OB_ASYNCHRONF1	Asynchronous error	X	X	7
OB81	OB81	OB_BUFFERVOLT	Buffer voltage	X	X	7
OB82	OB82	OB_DIAGNOSTIC_INT	Diagnostic interrupt	X	X	6
OB85	OB85	OB_ACCESS_ERR	Access error	X	X	7
OB86	OB86	OB_DP_EXPANSION_RA	Distributed I/O	X	X	6
OB87	OB87	OB_COMM_ERROR	Error, global data	X	X	7
OB90	OB90	OB_BACKGROUND	Background		X	7
OB100	OB100	OB_RESTART	Restart	X	X	6
OB102	OB102	OB_COLD_RESTART	Cold restart		X	7
OB 121	OB 121	OB_SYNCHRONF1	Synchronous error	X	X	7
OB122	OB122	OB_SYNCHRONF2	Synchronous error	X	X	7

Table 10: TRANSLINE organizational blocks

6.4.2.2 Function blocks (FB)

Standard FB	Project-specific FB	Symbol name	Description	840D sl	S7-300	Type
FB1 - FB29	FB1 - FB29		Basic PLC program 840D	X		1
FB1	FB1	RUN_UP	Basic PLC program 840D	X		1
	FB1	FB_RUN_UP	TRANSLINE library		X	2
FB2	FB2	GET	Basic PLC program 840D	X		1
FB3	FB3	PUT	Basic PLC program 840D	X		1
FB4	FB4	PI	Basic PLC program 840D	X		1
FB5	FB5	GETGUD	Basic PLC program 840D	X		1
FB7	FB7	PI_SERV2	Basic PLC program 840D	X		1
FB9	FB9	M2N	Basic PLC program 840D	X		1
FB10	FB10	SI_RELAY	Basic PLC program 840D	X		1
FB11	FB11	SI_BrakeTest	Basic PLC program 840D	X		1
FB29	FB29	DIAGNOSIS	Basic PLC program 840D	X		1
	FB30	FC_AX_MANAG	Management of NC axes	X		6
	FB31	DB_AXIS_1	Axis interface 1	X		6
	---	---	---			
	FB58	FB_AXIS_28	Axis interface 28	X		6
	FB59	FB_HMI_ASSIGNMENT	Assignment HMI screens	X	X	6
	FB60	FB_RESERVE_FB60	Reserved for Siemens			
	---	---	---			
	FB70	FB_RESERVE_FB70	Reserved for Siemens			

Standard FB	Project-specific FB	Symbol name	Description	840D sl	S7-300	Type
	FB71	FB_TM_1	Tool Manager SIN840D	X		7
	FB72	FB_TM_2	Tool Manager SIN840D	X		7
	FB73	FB_TM_3	Tool Manager SIN840D	X		7
	FB74	FB_TM_4	Tool Manager SIN840D	X		7
	FB75	FB_TM_5	Tool Manager SIN840D	X		7
	FB76	FB_TM_6	Tool Manager SIN840D	X		7
	FB77	FB_TM_7	Tool Manager SIN840D	X		7
	FB78	FB_TM_8	Tool Manager SIN840D	X		7
	FB79	FB_TM_9	Tool Manager SIN840D	X		7
	FB80	FB_RESERVE_FB80	Reserved for Siemens			
	FB81	FB_MANAG_IDENT	Identification system management	X	X	6
	FB82	FB_COMM_IDENT	Identification system communication	X	X	6
	FB83	FB_RESERVE_FB83	Reserved for Siemens			
	FB84	FB_RESERVE_FB84	Reserved for Siemens			
	FB85	FB_SI1	Safety Integrated	X		7
	FB86	FB_SI2	Safety Integrated	X		7

Standard FB	Project-specific FB	Symbol name	Description	840D sl	S7-300	Type
	FB87	FB_SI3	Safety Integrated	X		7
	FB88	FB_SI4	Safety Integrated	X		7
	FB89	FB_SI5	Safety Integrated	X		7
	FB91	FB_RESERVE_FB91	Reserved for Siemens			
	---	---	---			
	FB96	FB_RESERVE_FB96	Reserved for Siemens			
	FB97	FB_DP_DIAG_HMI	PROFIBUS diagnostics interface to HMI PRO	X	X	2
	FB98	FB_RESERVE_FB98	Reserved for Siemens			
	---	---	---			
	FB106	FB_RESERVE_FB106	Reserved for Siemens			
	FB107	FB_RES_HMILITE_FB107	Reserved for HMI Lite		X	2/8
	FB108	FB_RESERVE_FB108	Reserved for Siemens			
	FB109	FB_RESERVE_FB109	Reserved for Siemens			
	FB110	FB_NC_VAR	NC VAR selector	X		6
	FB111	FB_RESERVE_FB111	Reserved for Siemens			
	---	---	---			
	FB120	FB_RESERVE_FB120	Reserved for Siemens			
	FB121	FB_PROG_SEL_CH1	Program selection, channel 1	X		6
	FB122	FB_PROG_SEL_CH2	Program selection, channel 2	X		6
	FB123	FB_PROG_SEL_CH3	Program selection, channel 3	X		6
	FB124	FB_PROG_SEL_CH4	Program selection, channel 4	X		6

Standard FB	Project-specific FB	Symbol name	Description	840D sl	S7-300	Type
	FB125	FB_RESERVE_FB125	Reserved for Siemens			
	---	---	---			
	FB130	FB_RESERVE_FB130	Reserved for Siemens			
	FB131	FB_TMANAG_CH1	Tool monitoring, channel 1	X		6
	FB132	FB_TMANAG_CH2	Tool monitoring, channel 2	X		6
	FB133	FB_TMANAG_CH3	Tool monitoring, channel 3	X		6
	FB134	FB_TMANAG_CH4	Tool monitoring, channel 4	X		6
	FB135	FB_RESERVE_FB135	Reserved for Siemens			
	FB136	FB_MEASDEV1	Measuring device 1	X	X	7
	FB137	FB_MEASDEV2	Measuring device 2	X	X	7
	FB138	FB_MEASDEV3	Measuring device 3	X	X	7
	FB139	FB_MEASDEV4	Measuring device 4	X	X	7
	FB140	FB_NUTRUN1	Nut-runner system	X	X	7
	FB141	FB_NUTRUN2	Nut-runner system	X	X	7
	FB142	FB_NUTRUN3	Nut-runner system	X	X	7
	FB143	FB_NUTRUN4	Nut-runner system	X	X	7
	FB144	FB_NUTRUN5	Nut-runner system	X	X	7
	FB145	FB_NUTRUN6	Nut-runner system	X	X	7
	FB146	FB_NUTRUN7	Nut-runner system	X	X	7
	FB147	FB_RESERVE_FB147	Reserved for Siemens			
	---	---	---			
	FB149	FB_RESERVE_FB149	Reserved for Siemens			
	FB150	FB_SHIFTREGISTER	Shift register	X	X	6

Standard FB	Project-specific FB	Symbol name	Description	840D sl	S7-300	Type
	FB151	FB_TOOL_LIFETIME	Supplementary block, tool lifetime for HMI PRO	X	X	2
	FB152	FB_WORKPIECE_COUNTER	Supplementary block for workpiece count	X	X	2
	FB153	FB_CYCLE_TIME	Supplementary block for cycle time acquisition	X	X	2
	FB154	FB_RESERVE_FB154	Reserved for Siemens			
	---	---	---			
	FB159	FB_RESERVE_FB159	Reserved for Siemens			
	FB160	FB_USER_FB160	Free user block			
	---	---	---			
	FB400	FB_USER_FB400	Free user block			
	When using S7 Distributed Safety					
	FB179	F_SCA_I	Scale values of data type INT		X	1
	FB181	F_CTU	Count up		X	1
	FB182	F_CTD	Count down		X	1
	FB183	F_CTUD	Count up and down		X	1
	FB184	F_TP	Create pulse		X	1
	FB185	F_TON	Create ON delay		X	1
	FB186	F_TOF	Create delay (block number may not be changed when using the blocks F_ESTOP1 and F_FDBACK)		X	1
	FB187	F_ACK_OP	Fail-safe acknowledgment		X	1
	FB188	F_2HAND	Two-hand monitoring		X	1

Standard FB	Project-specific FB	Symbol name	Description	840D sl	S7-300	Type
	FB189	F_MUTING	Muting		X	1
	FB190	F_1oo2DI	1oo2 evaluation with discrepancy analysis		X	1
	FB211	F_2H_EN	Two-hand monitoring with enable		X	1
	FB212	F_MUT_P	Parallel muting		X	1
	FB215	F_ESTOP1	EMERGENCY STOP up to Stop Category 1		X	1
	FB216	F_FDBACK	Feedback monitoring		X	1
	FB217	F_SFDOOR	Safety door monitoring		X	1
	FB219	F_ACK_GL	Global acknowledgment of all F-I/Os in an F-runtime group		X	1
	FB223	F_SENDDP	Sending data (16 BOOL, 2 INT) via PROFIBUS DP		X	1
	FB224	F_RCVDP	Receiving data (16 BOOL, 2 INT) via PROFIBUS DP		X	1
	FB225	F_SENDS7	For CPUs 4xxF: Sending data (from F-DB) via S7 connections		X	1
	FB226	F_RCVS7	For CPUs 4xxF: Receive data (from F-DB) via S7 connections		X	1

Standard FB	Project-specific FB	Symbol name	Description	840D sl	S7-300	Type
	FB401	FB_RESERVE_FB401	Reserved for Siemens			
	---	---	---			
	FB443	FB_RESERVE_FB443	Reserved for Siemens			
	FB444	FB_HMI_ENERGY_CONSM PT CONSMPT	Energy consumption data processing	X	X	2
	FB445	FB_ENGY_CONSMPT MEASURED VALUES	Energy consumption data processing for measuring via measuring instrument (PAC4200)	X	X	4
	FB446	FB_ENGY_CONSMPT COUNTER	Energy consumption data processing for measuring via pulse counter	X	X	2
	FB447	FB_PROFIB_N_ALARM	Acquisition of alarms for PN/DP diagnostics	X	X	2
	FB448	FB_DEVSTATE	Device status for PLC applications	X	X	2
	FB449	FB_SL_COM	SL command processing	X	X	2
	FB450	FB_DIAG_EXECUTABLE	Block for detailed diagnostics, S7 GRAPH in the setup mode	X	X	2
	FB451	FB_EXECUTABLE	Evaluation of the executability of the S7 GRAPH manual movements	X	X	2
	FB452	FB_MAN_SELECT	Execution of S7 GRAPH manual movements	X	X	2
	FB453	FB_RESERVE_FB453	Reserved for Siemens			
	---	---	---			
	FB459	FB_RESERVE_FB459	Reserved for Siemens			

Standard FB	Project-specific FB	Symbol name	Description	840D sl	S7-300	Type
	FB460	FB_EE_DRIVER	Data acquisition of energy efficiency	X	X	2
	FB461	FB_EE_COM_EMS	Energy efficiency: Communication with EnMPro via PROFINET	X	X	2
	FB462	FB_EE_SUB_CALL	Energy efficiency: Communication via PROFINET	X	X	2
	FB463	FB_EE_VDMA	Energy efficiency: Assignment HMI PRO, VDMA protocol	X	X	2
	FB464	FB_EE_SPLIT	Energy efficiency: Distribution of energy types	X	X	2
	FB465	FB_RES_HMILITE_FB465	Reserved for HMI Lite		X	2/8
	FB466	FB_RESERVE_FB466	Reserved for Siemens			
	---	---	---			
	FB469	FB_RESERVE_FB469	Reserved for Siemens			
	FB470	FB_EE_COM_EMS_CP	Energy efficiency: Communication with EnMPro via CP to SIMATIC controller	X	X	2
	FB471	FB_EE_SUB_CALL_CP	Energy efficiency: Communication via CP to SIMATIC controller	X	X	2
	FB472	FB_RESERVE_FB472	Reserved for Siemens			
	FB473	FB_EE_COM_EMS_NCU	Energy efficiency: Communication with EnMPro via CP to SINUMERIK control system	X	X	2

Standard FB	Project-specific FB	Symbol name	Description	840D sl	S7-300	Type
	FB474	FB_EE_SUB_CALL_NCU	Energy efficiency: Communication via CP an SINUMERIK control system	X	X	2
	FB475	FB_RESERVE_FB475	Reserved for Siemens			
	---	---	---			
	FB480	FB_RESERVE_FB480	Reserved for Siemens			
	FB481	FB_END_CUSTOMER_FB481	Free block for end customer assignment	X	X	
	---	---	---			
	FB600	FB_END_CUSTOMER_FB600	Free block for end customer assignment	X	X	
	FB601	FB_USER_FB601	Free user block	X	X	
	---	---	---			
	FB999	FB_USER_FB999	Free user block	X	X	

Standard FB	Project-specific FB	Symbol name	Description	840D sl	S7-300	Type
	FB1000	FB_SINUMERIK_FB1000	Reserved for Siemens			
	---	---	---			
	FB1099	FB_SINUMERIK_FB1099	Reserved for Siemens			
	FB1100	FB_USER_FB1100	Free user block	X	X	
	---	---	---			
	FBmax	FB_USER_FBmax	Free user block	X	X	

Table 11: TRANSLINE function blocks

6.4.2.3 Function call (FC)

Standard FC	Project-specific FC	Symbol names	Description	840D sl	S7-300	Type
FC1-29	FC1-29		Basic PLC program 840D	X	* Parts	1
	FC1	FC_RUN_UP_S7	Parameterization for FC10 with SIMATIC PLC		X	2
FC2	FC2	GP_HP	Basic PLC program 840D	X		1
FC3	FC3	GP_PRAL	Basic PLC program 840D	X		1
FC5	FC5	GP_DIAG	Basic PLC program 840D	X		1
	---	---	---			
FC7	FC7	TM_REV	Basic PLC program 840D	X		1
FC8	FC8	TM_TRANS	Basic PLC program 840D	X		1
FC9	FC9	ASUB	Basic PLC program 840D	X		1
FC10	FC10	AL_MSG	Basic PLC program 840D	X	X	1
	---	---	---			
FC13	FC13	HHU_DISP	Basic PLC program 840D	X		1
	---	---	---			
FC17	FC17	YDELTA	Basic PLC program 840D	X		1
FC18	FC18	SPINCTRL	Basic PLC program 840D	X		1
FC19	FC19	MCP_IFM	Basic PLC program 840D	X		1
FC21	FC21	PLC_NCK	Basic PLC program 840D	X		1
FC22	FC22	TM_DIR	Basic PLC program 840D	X		1
FC24	FC24	MCP_IFM2	Basic PLC program 840D	X		1
FC25	FC25	MCP_IFT	Basic PLC program 840D	X		1
FC26	FC26	HPU_MCP	Basic PLC program 840D (note: must not be used for TRANSLINE)	X		1

Standard FC	Project-specific FC	Symbol names	Description	840D sl	S7-300	Type
	FC30	FC_AX_MANAG	Management of NC axes	X		6
	FC31	FC_AXIS_1	Axis interface 1	X		6
	---	---	---			
	FC56	FC_AXIS_26	Axis interface 26	X		6
	FC57	FC_DIRECTKEYS	Marshalling, U op. control	X	X	2
	FC58	FC_RESERVE_FC58	Reserved for Siemens			
	FC59	FC_HMI_ASSIGNMENT	HMI supply	X	X	6
	FC60	FC_BASIC_SIGNALS	general basic signals	X	X	6
	FC61	FC_OPERATING_MODES	Management of operating modes MSST, PHG	X	X	6
	FC62	FC_DEC_HMI	Decoding HMI PRO signals	X	X	2
	FC63	FC_RESERVE_FC63	Reserved for Siemens			
	---	---	---			
	FC66	FC_RESERVE_FC66	Reserved for Siemens			
	FC67	FC_RES_HMILITE_FC67	Reserved for HMI Lite		X	4/8
	FC68	FC_RES_HMILITE_FC68	Reserved for HMI Lite		X	2/8
	FC69	FC_RES_HMILITE_FC69	Reserved for HMI Lite		X	2/8
FC70	FC70	G7_STD_1	Standard block for S7 GRAPH (is generated when compiling)	X	X	1
FC71	FC71	G7_STD_2	Standard block for S7 GRAPH (is generated when compiling)	X	X	1
FC72	FC72	G7_STD_3	Standard block for S7 GRAPH (is generated when compiling)	X	X	1

Standard FC	Project-specific FC	Symbol names	Description	840D sl	S7-300	Type
FC73	FC73	G7_STD_4	Standard block for S7 GRAPH (is generated when compiling)	X	X	1
	FC74	FC_TM_1	Tool Manager SIN840D	X		7
	FC75	FC_TM_2	Tool Manager SIN840D	X		7
	FC76	FC_TM_3	Tool Manager SIN840D	X		7
	FC77	FC_TM_4	Tool Manager SIN840D	X		7
	FC78	FC_TM_5	Tool Manager SIN840D	X		7
	FC79	FC_TM_6	Tool Manager SIN840D	X		7
	FC80	FC_RESERVE_FC80	Reserved for Siemens			
	FC81	FC_RESERVE_FC81	Reserved for Siemens			
FC44	FC82	FC_MOBY_ASM450	MOBY-I/RF300 ASM450	X	X	1
FC54	FC83	FC_MOBY_ASM450_CP	MOBY-I/RF300 ASM450 via CP	X	X	1
FC45	FC84	FC_MOBY_ASM473	MOBY-I/RF300 ASM473	X	X	1

Standard FC	Project-specific FC	Symbol names	Description	840D sl	S7-300	Type
	FC85	FC_SI1	Safety Integrated	X		7
	FC86	FC_SI2	Safety Integrated	X		7
	FC87	FC_SI3	Safety Integrated	X		7
	FC88	FC_SI4	Safety Integrated	X		7
	FC89	FC_SI5	Safety Integrated	X		7
	FC90	FC_CBA_RECV	Receive data for CBA	X	X	6
	FC91	FC_CBA_SEND	Send data for CBA	X	X	6
	FC92	FC_MANAG_DP_RECV	Management, PROFIBUS DP (receive)	X	X	6
	FC93	FC_MANAG_DP_SEND	Management, PROFIBUS DP (send)	X	X	6
FC5	FC94	FC_FDL_RECV	FDL Receive	X	X	1
FC6	FC95	FC_FDL_SEND	FDL Send	X	X	1
	FC96	FC_RESERVE_FC96	Reserved for Siemens			
	FC97	FC_RESERVE_FC97	Reserved for Siemens			
FC2	FC98	FC_DP_RECV	DP Receive for CP342-5		X	1
FC1	FC99	DP_SEND	DP Send for CP342-5		X	1
FC3	FC100	DP_DIAG	DP diagnostics for CP342-5		X	1
	FC101	FC_MANAG_AG_RECV	Management (Receive)	X	X	6
	FC102	FC_MANAG_AG_SEND	Management (Send)	X	X	6
FC6	FC103	AG_RECV	Ethernet receive		X	1
FC5	FC104	AG_SEND	Ethernet send		X	1
	FC105	FC_RESERVE_FC105	Reserved for Siemens			
	FC106	FC_RES_HMILITE_FC106	Reserved for HMI Lite		X	2/8
	FC107	FC_RES_HMILITE_FC107	Reserved for HMI Lite		X	2/8

Standard FC	Project-specific FC	Symbol names	Description	840D sl	S7-300	Type
	FC108	FC_RES_HMILITE_FC108	Reserved for HMI Lite		X	2/8
	FC109	FC_RES_HMILITE_FC109	Reserved for HMI Lite		X	2/8
	FC110	FC_BAG1	Supply mode group 1	X		6
	FC111	FC_BAG2	Supply mode group 2	X		6
	FC112	FC_RESERVE_FC112	Reserved for Siemens			
	---	---	---			
	FC120	FC_RESERVE_FC120	Reserved for Siemens			
	FC121	FC_CHAN1	Supply channel1	X		6
	FC122	FC_CHAN2	Supply channel2	X		6
	FC123	FC_CHAN3	Supply channel3	X		6
	FC124	FC_CHAN4	Supply channel4	X		6
	FC125	FC_RESERVE_FC125	Reserved for Siemens			
	---	---	---			
	FC130	FC_RESERVE_FC130	Reserved for Siemens			
	FC131	FC_MANAG_TOOLMON	Management, tool monitoring	X		6
	FC132	FC_RESERVE_FC132	Reserved for Siemens			
	---	---	---			
	FC135	FC_RESERVE_FC135	Reserved for Siemens			
	FC136	FC_MEASDEV1	Measuring device	X		7
	FC137	FC_MEASDEV2	Measuring device	X		7
	FC138	FC_MEASDEV3	Measuring device	X		7
	FC139	FC_MEASDEV4	Measuring device	X		7
	FC140	FC_NUTRUN1	Nut-runner system	X	X	7
	FC141	FC_NUTRUN2	Nut-runner system	X	X	7

Standard FC	Project-specific FC	Symbol names	Description	840D sl	S7-300	Type
	FC142	FC_NUTRUN3	Nut-runner system	X	X	7
	FC143	FC_NUTRUN4	Nut-runner system	X	X	7
	FC144	FC_NUTRUN5	Nut-runner system	X	X	7
	FC145	FC_NUTRUN6	Nut-runner system	X	X	7
	FC146	FC_NUTRUN7	Nut-runner system	X	X	7
	FC147	FC_RESERVE_FC147	Reserved for Siemens			
	FC148	FC_RESERVE_FC148	Reserved for Siemens			
	FC149	FC_PROT_DOOR	Protective doors	X	X	6
	FC150	FC_SHIFTREGISTER	Management, shift register	X	X	6
☝	FC151	FC_ADDON_HMI	Management, supplementary blocks	X	X	6
☝	FC151	FC_RES_HMILITE_FC151	Reserved for HMI Lite		X	4/8
	FC152	FC_RESERVE_FC152	Reserved for Siemens			
	---	---	---			
	FC154	FC_RESERVE_FC154	Reserved for Siemens			
	FC155	FC_FAULT_MESS	Error messages and operational messages	X	X	6
	FC156	FC_DIAGNOSTICS	Diagnostics call	X	X	6
	FC157	FC_[NAME]	Reserved for HMI screens	X	X	6
	FC158	FC_[NAME]	Reserved for HMI screens	X	X	6
	FC159	FC_[NAME]	Reserved for HMI screens	X	X	6

☝ This block is available as an HMI PRO block and as an HMI Lite block.

Standard FC	Project-specific FC	Symbol names	Description	840D sl	S7-300	Type
	FC160	FC_USER_FC160	Free user block			
	---	---	---			
	FC399	FC_USER_FC399	Free user block			
	When using S7 Distributed Safety					
	FC174	F_SHL_W	Shift Left 6 bits		X	1
	FC175	F_SHR_W	Shift Right 16 bits		X	1
	FC176	F_BO_W	Convert 16 data elements of data type BOOL to a data element of data type WORD		X	1
	FC177	F_W_BO	Convert a data element of data type WORD to 16 data elements of data type BOOL		X	1
	FC178	F_INT_WR	Write value of data type INT indirectly to an F-DB		X	1
	FC179	F_INT_RD	Read value of data type INT indirectly from an F-DB		X	1
	FC400	FC_MPP	Evaluates and controls the MPP483 control elements	X	X	2
	FC401	FC_MCP	Evaluates and controls the MCP483 control elements	X	X	2
	FC402	FC_HT8	Evaluates and controls the HT8 control elements	X	X	2
	FC403	FC_HT2	Evaluates and controls the HT2 control elements	X	X	2
	FC404	FC_MPP1500	Evaluates and controls the MPP1500 control elements	X	X	2
	FC405	FC_OP_TL_FM	Evaluation and control of the U keys screen	X	X	2

Standard FC	Project-specific FC	Symbol names	Description	840D sl	S7-300	Type
	FC406	FC_RESERVE_FC406	Reserved for Siemens			
	FC407	FC_MODE	Switching over operating modes taking into account DB407 (interlocks safe operating mode)	X	X	2
	FC408	FC_TL_FM	Selection of the TRANSLINE functions	X	X	2
	FC409	FC_NC_FM	Selection of the NC functions	X	X	2
	FC410	FC_RESERVE_FC410	Reserved for Siemens			
	---	---	---			
	FC443	FC_RESERVE_FC443	Reserved for Siemens			
	FC444	FC_CALL_ ENERGY_ACQUISITION	Energy consumption data acquisition	X	X	4
	FC445	FC_RESERVE_FC445	Reserved for Siemens			
	---	---	---			
	FC461	FC_RESERVE_FC461	Reserved for Siemens			
	FC462	FC_RES_HMILITE_FC462	Reserved for HMI Lite		X	2/8
	FC463	FC_RESERVE_FC463	Reserved for Siemens			
	---	---	---			
	FC480	FC_RESERVE_FC480	Reserved for Siemens			

Standard FC	Project-specific FC	Symbol names	Description	840D sl	S7-300	Type
	FC481	FC_END_CUSTOMER_FC 481	Free block for end customer assignment	X	X	
	---	---	---			
	FC600	FC_END_CUSTOMER_FC 600	Free block for end customer assignment	X	X	
	FC601	FC_USER_FC601	Free user block	X	X	
	---	---	---			
	FC999	FC_USER_FC999	Free user block	X	X	
	FC1000	FC_SINUMERIK_FC1000	Reserved for Siemens	X		
	---	---	---			
	FC1004	FC_SINUMERIK_FC1004	Reserved for Siemens	X		
	FC1005	AG_SEND	AG_SEND for NC_SL	X		1
	FC1006	AG_RECV	AG_RECV for NC_SL	X		1
	FC1007	AG_LOCK	AG_LOCK for NC_SL	X		1
	FC1008	AG_UNLOCK	AG_UNLOCK for NC_SL	X		1
	FC1009	AG_CNTRL	AG_CNTRL for NC_SL	X		1
	FC1010	FC_SINUMERIK_FC1010	Reserved for Siemens	X		
	---	---	---			
	FC1099	FC_SINUMERIK_FC1099	Reserved for Siemens	X		
	FC1100	FC_USER_FC1100	Free user block	X		
	---	---	---			
	FCmax	FC_USER_FCmax	Free user block	X		

Table 12: TRANSLINE function calls

6.4.2.4 Data block (DB)

Standard DB	Project-specific DB	Symbol names	Description	840D sl	S7-300	Type
DB1-58	DB1-58		Reserved for Siemens basic PLC program 840D	X	* Parts	1
DB2	DB2	SIN_ALARM_SERVER	Error/operational messages interface, user area 0…24	X	X	1
DB3	DB3	SYSTEM1	PLC messages	X	X	1
DB4	DB4	SYSTEM2	PLC messages	X	X	1
DB9	DB9	NCK_COMP	NC compile cycles interface	X		1
DB10	DB10	NCK	NC interface	X	X	1
DB11	DB11	BAG_1	Mode group interface	X		1
DB18	DB18	SPL	SPL interface	X		1
DB19	DB19	MMC	MMC interface	X	X	1
DB21	DB21	DB_CHAN_1	Interface NC channel 1	X		1
	---	---	---			
DB30	DB30	DB_CHAN_10	Interface NC channel 10	X		1
DB31	DB31	DB_AXIS_1	Axis 1 interface	X		1
	---	---	---			
DB58	DB58	DB_AXIS_28	Axis 28 interface	X		1
	DB59	DB_HMI	HMI PRO data block	X	X	2
	DB60	DB_HGDB	S7-HiGraph data interface	X	X	6
	DB61	DB_RESERVE_DB61	Reserved for Siemens			
	DB62	DB_DEC_HMI	Target of the bits from FC62	X	X	6
	DB63	DB_RESERVE_DB63	Reserved for Siemens			
	---	---	---			

Standard DB	Project-specific DB	Symbol names	Description	840D sl	S7-300	Type
	DB66	DB_RESERVE_DB66	Reserved for Siemens			
	DB67	DB_RES_HMILITE_DB67	Reserved for HMI Lite		X	4/8
	DB68	DB_RES_HMILITE_DB68	Reserved for HMI Lite		X	4/8
	DB69	DB_RES_HMILITE_DB69	Reserved for HMI Lite		X	2/8
	DB70	DB_RESERVE_DB70	Reserved for Siemens			
DB71	DB71	DB_TM_LO_RE	Tool Management	X		1
DB72	DB72	DB_SPINDLE	Tool Management	X		1
DB73	DB73	DB_REVOLVER	Tool Management	X		1
	DB74	DB_RESERVE_DB74	Reserved for Siemens			
DB75	DB75	DB_DEC_LIST	M decoding	X		1
DB76	DB76	DB_SIGN_LIST	M decoding	X		1
	DB77	DB_TM_BUFFER_STOR	Tool Management	X		1
	DB78	DB_RESERVE_DB78	Reserved for 840D			
	---	---	---			
	DB80	DB_RESERVE_DB80	Reserved for 840D			
	DB81	DB_IDENT	Instance DB identification system	X	X	6
	DB82	DB_IDENT_OPDB	Identification system command data block	X	X	6
	DB83	DB_IDENT_DATA	Identification system data	X	X	6
	DB84	DB_RESERVE_DB84	Reserved for Siemens			
	DB85	DB_SI1	Safety Integrated	X		7

Standard DB	Project-specific DB	Symbol names	Description	840D sl	S7-300	Type
	DB86	DB_SI2	Safety Integrated	X		7
	DB87	DB_SI3	Safety Integrated	X		7
	DB88	DB_SI4	Safety Integrated	X		7
	DB89	DB_SI5	Safety Integrated	X		7
	DB90	DB_CBA_RECV	Receive data for CBA	X	X	6
	DB91	DB_CBA_SEND	Send data for CBA	X	X	6
	DB92	DB_RESERVE_DB92	Reserved for Siemens			
	DB93	DB_RESERVE_DB93	Reserved for Siemens			
	DB94	DB_RECV	FDL RECEIVE	X	X	6
	DB95	DB_SEND	FDL SEND	X	X	6
	DB96	DB_RESERVE_DB96	Reserved for Siemens			
	DB97	DB_DP_DIAG_DP	Interface to HMI PRO	X	X	6
	DB98	DB_DP_RECV	DP Receive data	X	X	6
	DB99	DB_DP_SEND	DP Send data	X	X	6
	DB100	DB_DP_DIAG	DP diagnostics CP342-5	X	X	6
	DB101	DB_RESERVE_DB101	Reserved for Siemens			
	DB102	DB_RESERVE_DB102	Reserved for Siemens			
	DB103	DB_AG_RECV	Ethernet Receive data	X	X	6
	DB104	DB_AG_SEND	Ethernet Send data	X	X	6
	DB105	DB_RESERVE_DB105	Reserved for Siemens			
	DB106	DB_RES_HMILITE_DB106	Reserved for HMI Lite		X	4/8
	DB107	DB_RES_HMILITE_DB107	Reserved for HMI Lite		X	2/8

Standard DB	Project-specific DB	Symbol names	Description	840D sl	S7-300	Type
	DB108	DB_RESERVE_DB108	Reserved for Siemens			
	DB109	DB_RESERVE_DB109	Reserved for Siemens			
	DB110	DB_NCVAR_R_W	Read/write NC variables	X		6
	DB111	DB_RESERVE_DB111	Reserved for Siemens			
	DB112	DB_NC_DATA	NC data NC-Var selector	X		6
	DB113	DB_NC_VALUES	NC setpoint/actual values	X		6
	DB114	DB_RESERVE_DB114	Reserved for Siemens			
	---	---	---			
	DB120	DB_RESERVE_DB120	Reserved for Siemens			
	DB121	DB_PROG_SELECT_CH1	Instance DB for program selection channel 1	X		6
	DB122	DB_PROG_SELECT_CH2	Instance DB for program selection channel 2	X		6
	DB123	DB_PROG_SELECT_CH3	Instance DB for program selection channel 3	X		6
	DB124	DB_PROG_SELECT_CH4	Instance DB for program selection channel 4	X		6
	DB125	DB_RESERVE_DB125	Reserved for Siemens			
☝	DB126	DB_HMI_ALARM_SERVER	Error and operational messages via HMI PRO	X	X	6
☝	DB126	DB_RES_HMILITE_DB126	Reserved for HMI Lite		X	6/8

☝ This block is available as an HMI PRO block and as an HMI Lite block.

Standard DB	Project-specific DB	Symbol names	Description	840D sl	S7-300	Type
	DB127	DB_RESERVE_DB127	Reserved for Siemens			
	---	---	---			
	DB130	DB_RESERVE_DB130	Reserved for Siemens			
	DB131	DB_TOOLMON_CH1	Tool monitoring channel1	X		6
	DB132	DB_TOOLMON_CH2	Tool monitoring channel2	X		6
	DB133	DB_TOOLMON_CH3	Tool monitoring channel3	X		6
	DB134	DB_TOOLMON_CH4	Tool monitoring channel4	X		6
	DB135	DB_RESERVE_DB135	Reserved for Siemens			
	DB136	DB_MEASDEV1	Measuring device 1	X		7
	DB137	DB_MEASDEV2	Measuring device 2	X		7
	DB138	DB_MEASDEV3	Measuring device 3	X	X	7
	DB139	DB_MEASDEV4	Measuring device 4	X	X	7
	DB140	DB_NUTRUN1	Nut-runner system (DB1)	X	X	7
	DB141	DB_NUTRUN2	Nut-runner system (DB2)	X	X	7
	DB142	DB_NUTRUN3	Nut-runner system (DB3)	X	X	7
	DB143	DB_NUTRUN4	Nut-runner system (DB4)	X	X	7
	DB144	DB_NUTRUN5	Nut-runner system (DB5)	X	X	7
	DB145	DB_NUTRUN6	Nut-runner system (DB6)	X	X	7
	DB146	DB_NUTRUN7	Nut-runner system (DB7)	X	X	7

Standard DB	Project-specific DB	Symbol names	Description	840D sl	S7-300	Type
	DB147	DB_RESERVE_DB147	Reserved for Siemens			
	---	---	---			
	DB149	DB_RESERVE_DB149	Reserved for Siemens			
	DB150	DB_SHIFTREGISTER	Data, shift register	X	X	6
	DB151	DB_TOOL_LIFETIME	Instance DB for tool life	X	X	2
	DB152	DB_WORKPIECE_COUNTER	Instance DB for part counter	X	X	2
	DB153	DB_CYCLE_TIME	Instance DB for cycle time acquisition	X	X	2
	DB154	DB_RESERVE_DB154	Reserved for Siemens			
	DB155	DB_RESERVE_DB155	Reserved for Siemens			
	DB156	DB_DEVICE_DIAGN	Interface for device diagnostics	X	X	2
	DB157	DB_RESERVE_DB157	Reserved for Siemens			
	---	---	---			
	DB159	DB_RESERVE_DB159	Reserved for Siemens			
	DB160	DB_USER_DB160	Free user block			
	---	---	---			
	DB399	DB_USER_DB399	Free user block			
	DB400	DB_MPP	Parameterization of the MPP483 control elements	X	X	6
	DB401	DB_MCP	Parameterization of the MCP483 control elements	X	X	6
	DB402	DB_HT8	Parameterization of the HT8 control elements	X	X	6

Standard DB	Project-specific DB	Symbol names	Description	840D sl	S7-300	Type
	DB403	DB_HT2	Parameterization of the HT2 control elements	X	X	6
	DB404	DB_MPP1500	Parameterization of the MPP1500 control elements	X	X	6
	DB405	DB_OP_TL_FM	Parameterization of the U keys screen			
	DB406	DB_DEVICE_INTERFACE	Device interface DB for MPP, MCP, HT8, HT2 and U key screen	X	X	6
	DB407	DB_MODE_INTERLOCKS	Locking of the key functions at the device interface	X	X	6
	DB408	DB_RESERVE_DB408	Reserved for Siemens			
	DB409	DB_NC_HMI_INTERFACE	Interface between HMI and PLC	X	X	6
	DB410	DB_RESERVE_DB410	Reserved for Siemens			
	---	---	---			
	DB443	DB_RESERVE_DB443	Reserved for Siemens			
	DB444	DB_HMI_ENERG_USE	Instance DB for processing the energy consumption data	X	X	2
	DB445	DB_RESERVE_DB445	Reserved for Siemens			
	DB446	DB_RESERVE_DB446	Reserved for Siemens			
	DB447	DB_PROFIB_N_ALARM	Instance DB for device diagnostics FB449 (when using device diagnostics and PROFINET diagnostics at the same time)	X	X	2
	DB448	DB_DEVSTATE	Instance DB for FB448	X	X	2

Standard DB	Project-specific DB	Symbol names	Description	840D sl	S7-300	Type
	DB449	DB_SL_COM	Instance DB for FB449	X	X	2
	DB450	DB_DIAG_DETAIL_HAND	Interface to HMI PRO process diagnostics	X	X	2
	DB451	DB_EXECUTABLE	Instance DB for FB451	X	X	2
	DB452	DB_MAN_SELECT	Instance DB for FB452	X	X	2
	DB453	DB_MAN_PLUS_1	DB selection PLUS for manual selection	X	X	6
	DB454	DB_MAN_MINUS_1	DB selection MINUS for manual selection	X	X	6
	DB455	DB_MAN_PLUS_2	DB selection PLUS for manual selection 2	X	X	6
	DB456	DB_MAN_MINUS_2	DB selection MINUS for manual selection 2	X	X	6
	DB457	DB_RESERVE_DB457	Reserved for Siemens			
	---	---	---			
	DB460	DB_RESERVE_DB460	Reserved for Siemens			
	DB461	DB_RES_HMILITE_DB461	Reserved for HMI Lite		X	2/8
	DB462	DB_RES_HMILITE_DB462	Reserved for HMI Lite		X	2/8
	DB463	DB_RESERVE_DB463	Reserved for Siemens			
	DB464	DB_RESERVE_DB464	Reserved for Siemens			
	DB465	DB_RES_HMILITE_DB465	Reserved for HMI Lite		X	2/8
	DB466	DB_RESERVE_DB466	Reserved for Siemens			
	DB467	DB_EE_CONFIG	Configuration Energy efficiency	X	X	2
	DB468	DB_EE_DATA_HUB	Data management Energy efficiency	X	X	2

Standard DB	Project-specific DB	Symbol names	Description	840D sl	S7-300	Type
	DB469	DB_EE_DATA_COM	Data management Measured values and communication buffer	X	X	2
	DB470	DB_RESERVE_DB470	Reserved for Siemens			
	---	---	---			
	DB480	DB_RESERVE_DB480	Reserved for Siemens			
	DB481	DB_END_CUSTOMER_DB 481	Free block for end customer assignment	X	X	
	---	---	---			
	DB600	DB_END_CUSTOMER_DB 600	Free block for end customer assignment	X	X	
	DB601	DB_USER_DB601	Free user block	X	X	
	---	---	---			
	DB999	DB_USER_DB999	Free user block	X	X	
	DB1000	DB_SINUMERIK_DB1000	Reserved for Siemens	X	X	
	---	---	---			
	DB1099	DB_SINUMERIK_DB1099	Reserved for Siemens	X	X	
	DB1100	DB_USER_DB1100	Free user block	X	X	
	---	---	---			
	DBmax	DB_USER_DBmax	Free user block	X	X	

Table 13: TRANSLINE data blocks

6.4.2.5 UDTs User Data Types

Standard UDT	Project-specific UDT	Symbol names	Description	840D sl	S7-300	Type
	UDT 1	UDT_SELECT	UDT for DB453-DB456 S7 Graph manual selection	X	X	1
NST_UDT	UDT 2	UDT_FBM	Error/operational messages interface, user area 0…31	X	X	1
NCK_UDT	UDT10	UDT_NCK	NCK interface	X		1
BAG_UDT	UDT11	UDT_bag	Mode groups interface	X		1
MMC_UDT	UDT 19	UDT_MMC	MMC interface	X		1
Channel_UDT	UDT 21	UDT_CHANNEL	Channel interface	X		1
Axis/spindle UDT	UDT 31	UDT_AX_SPIN	Axis/spindle interface	X		1
	UDT 59	UDT_DATA_BAR	Interface to HMI PRO	X	X	2
	UDT 69	UDT_MOBY_SCREEN		X	X	2
	UDT 71	UDT_TM	Tool Management	X		1
	UDT 72	UDT_TM	Tool Management	X		1
	UDT 73	UDT_TM	Tool Management	X		1
	UDT 102	UDT_RES_ HMILITE_UDT102	Reserved for HMI Lite		X	2/8
	UDT 450	UDT_VAR_LAYOUT	UDT for PLC interface Var. layout	X		2

Table 14: TRANSLINE data types

6.4.2.6 Bit memories (M)

Address	Symbol	840D sl	S7-300
M 0.0	m_zero	X	X
M 0.1	m_one	X	X
M 0.2	m_dummy_02	X	X
M 0.3	m_dummy_03	X	X
M 0.4	m_dummy_4	X	X
M 0.5	m_restart	X	X
M 0.6	m_startup	X	X
M 0.7	m_construct	X	X
M 1.0	m_clock_0.1s	X	X
M 1.1	m_clock_0.2s	X	X
M 1.2	m_clock_0.4s	X	X
M 1.3	m_clock_0.5s	X	X
M 1.4	m_clock_0.8s	X	X
M 1.5	m_clock_1.0s	X	X
M 1.6	m_clock_1.6s	X	X
M 1.7	m_clock_2.0s	X	X

6.4.3 Program structure

The following PLC program structures are described on the basis of the control used.

Variant 1

S7-300 controller with operator panel (not applicable for Daimler Powertrain requirement specification 2021).

Variant 2

SINUMERIK 840D sl with operator panel

The software structure must be adapted to the required conditions. As a rule, unused functions and options are omitted.

Machine manufacturers can also call up their application-specific blocks from the management blocks, resulting in a clear and uniform program structure.

If deviations are required in the structure, they must be noted in the PLC documentation.

Solutions for Powertrain HMI PRO

The interface DB DB_HMI (DB59) is used for HMI PRO display functions. The user program addresses the DB in the corresponding range in order to implement appropriate display functions. The description of the interface bits can be found in the online help for the HMI PRO CS configuration tool.

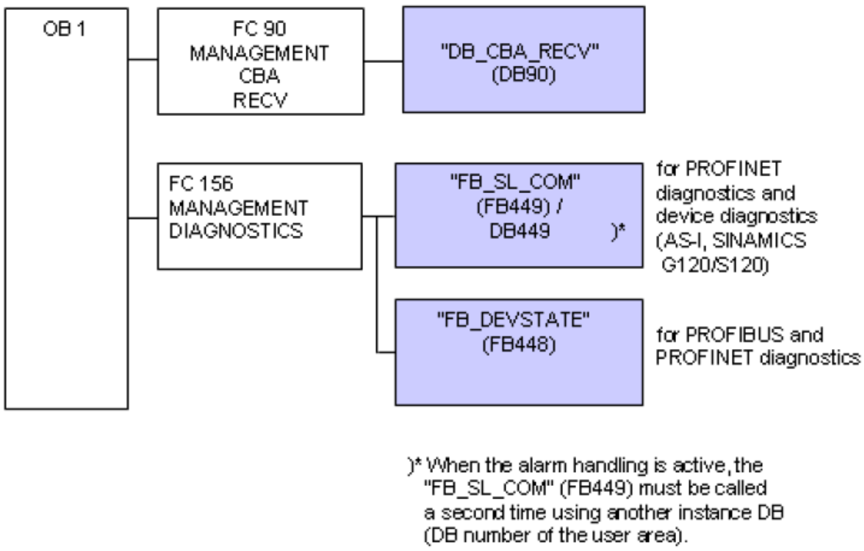
6.4.3.1 SIMATIC S7 controller

The blocks depicted in the program structure have the following meanings:

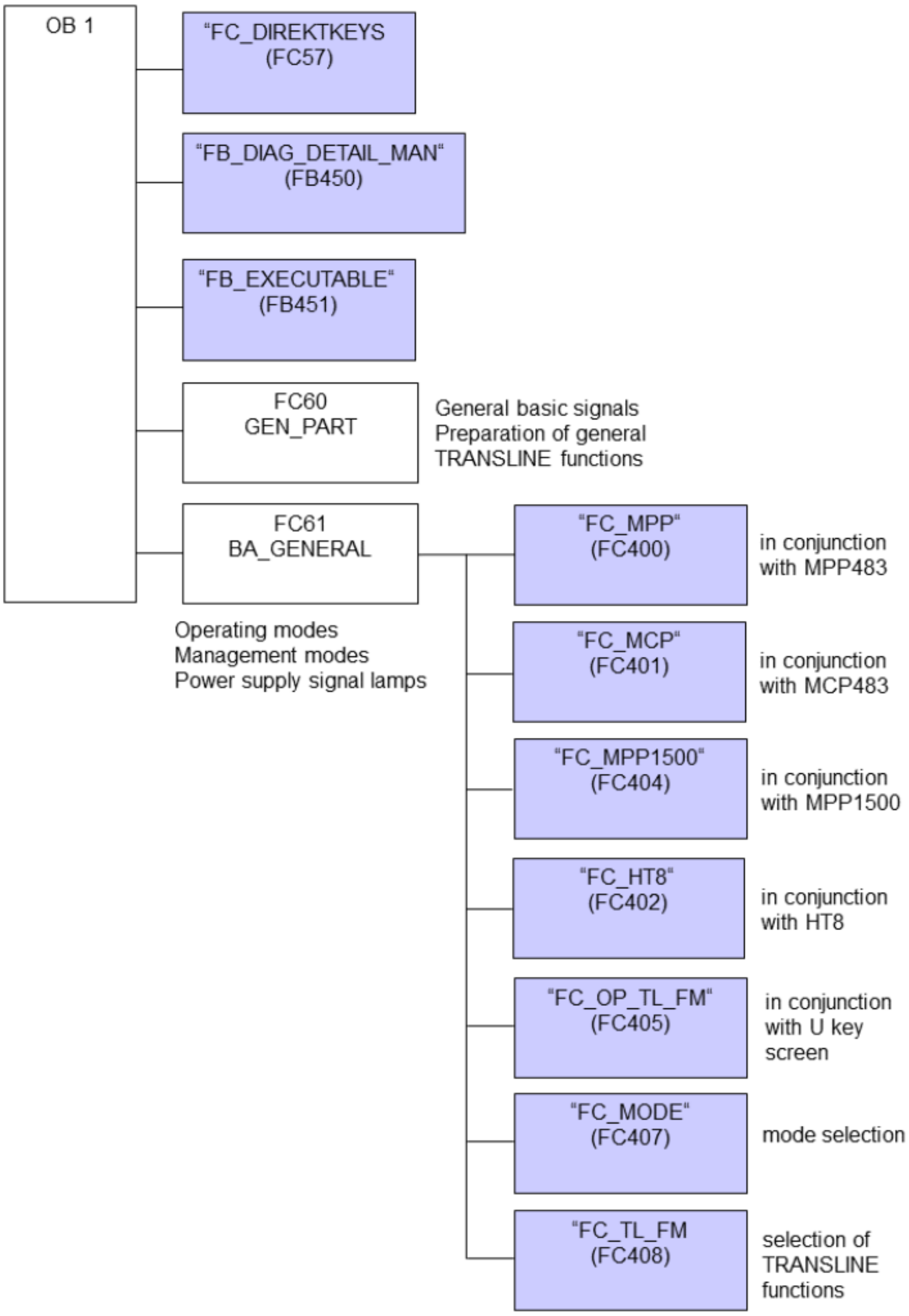
- Box with white background: Blocks must be supplemented or created by the user.
- Box with gray background: Standard blocks for TRANSLINE projects.

The background color relates to the OB/FB/FC type. The associated DBs may have to be adapted by the user.

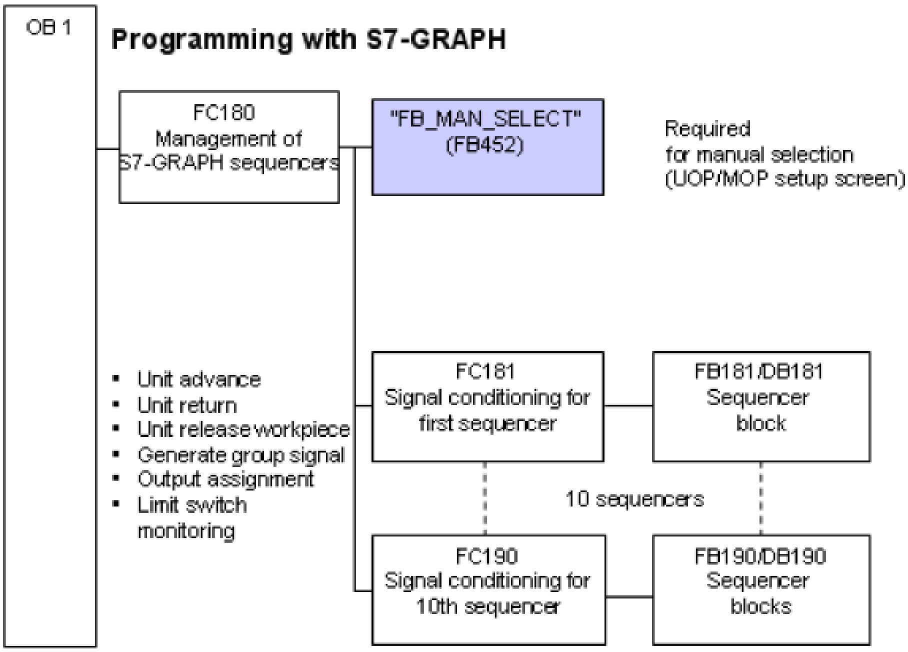
Part 1



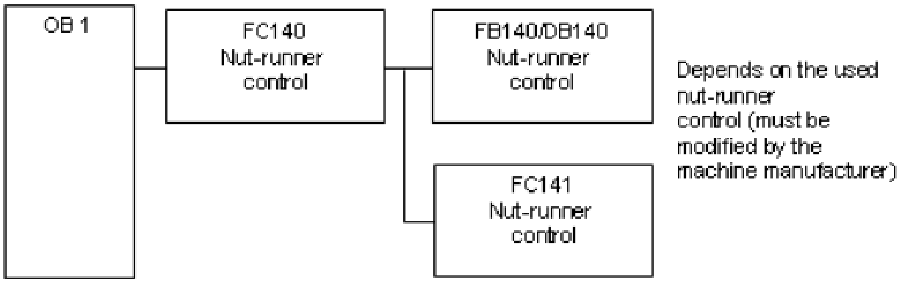
Part 2


OB 1
"FC_DIREKTKEYS
(FC57)
"FB_DIAG_DETAIL_MAN"
(FB450)
"FB_EXECUTABLE"
(FB451)
FC60
GEN_PART
General basic signals
Preparation of general
TRANSLINE functions
FC61
BA_GENERAL
Operating modes
Management modes
Power supply signal lamps
"FC_MPP"
(FC400)
in conjunction
with MPP483
"FC_MCP"
(FC401)
in conjunction
with MCP483
"FC_MPP1500"
(FC404)
in conjunction
with MPP1500
"FC_HT8"
(FC402)
in conjunction
with HT8
"FC_OP_TL_FM"
(FC405)
in conjunction
with U key
screen
"FC_MODE"
(FC407)
mode selection
"FC_TL_FM
(FC408)
selection of
TRANSLINE
functions

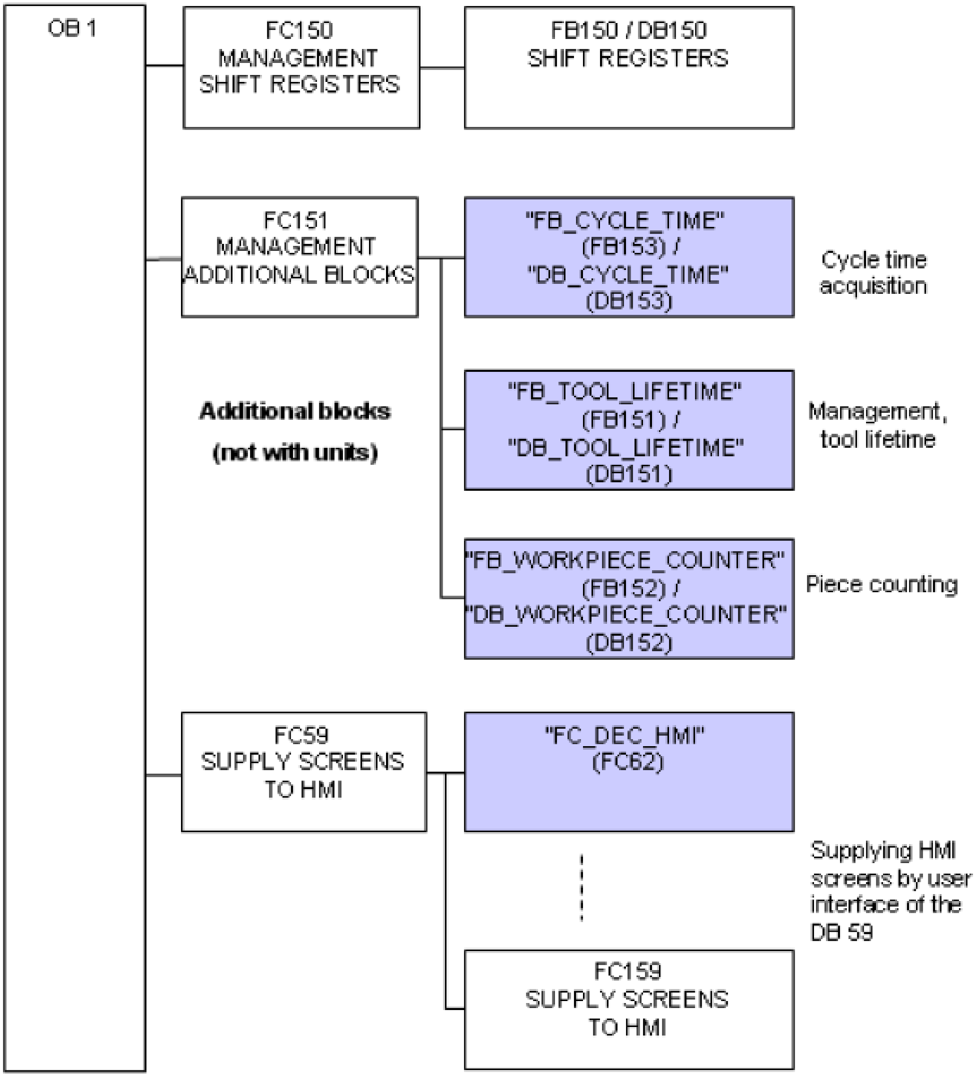
Part 3


OB 1
Programming with S7-GRAPH
FC180
Management of
S7-GRAPH sequencers
"FB_MAN_SELECT"
(FB452)
Required
for manual selection
(UOP/MOP setup screen)
▪ Unit advance
▪ Unit return
▪ Unit release workpiece
▪ Generate group signal
▪ Output assignment
▪ Limit switch
monitoring
FC181
Signal conditioning for
first sequencer
FB181/DB181
Sequencer
block
10 sequencers
FC190
Signal conditioning for
10th sequencer
FB190/DB190
Sequencer
blocks

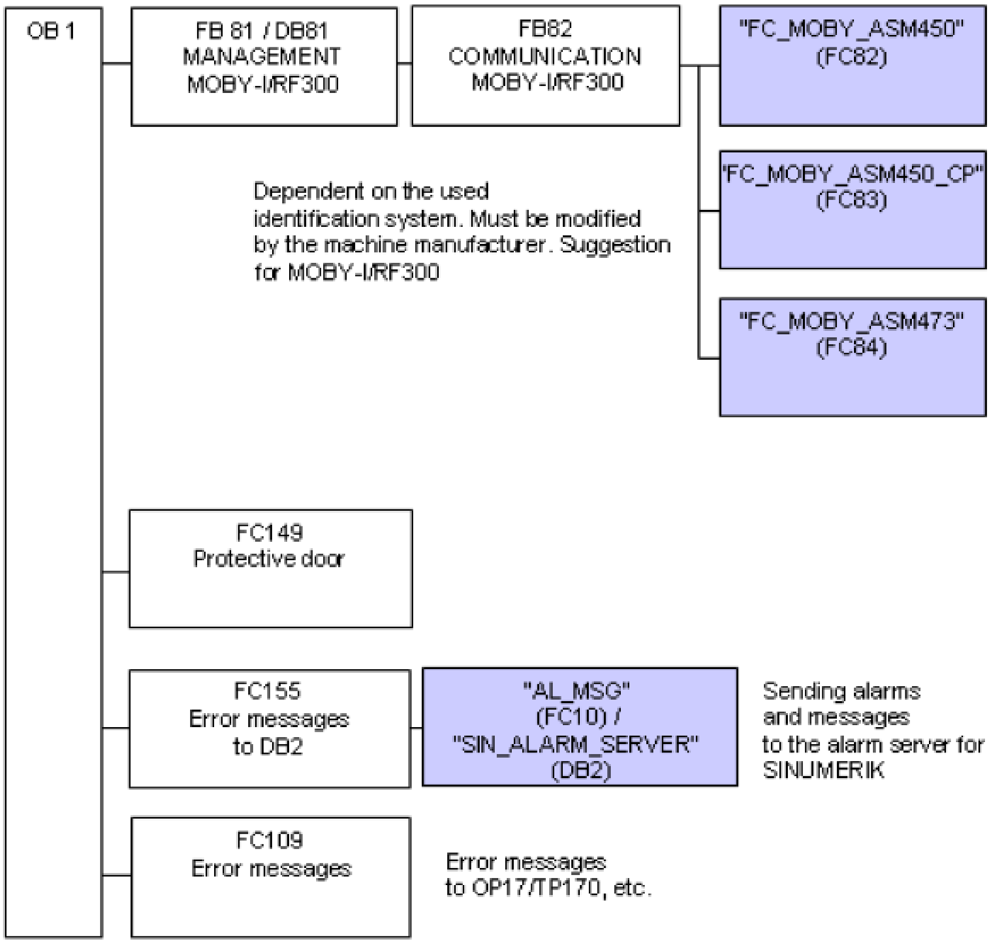
Part 4


OB 1
FC140
Nut-runner
control
FB140/DB140
Nut-runner
control
Depends on the used
nut-runner
control (must be
modified by the
machine manufacturer)
FC141
Nut-runner
control

Part 5

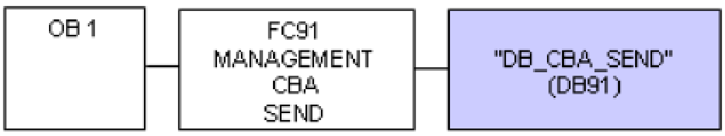

OB 1
FC150 MANAGEMENT SHIFT REGISTERS
FB150 / DB150 SHIFT REGISTERS
FC151 MANAGEMENT ADDITIONAL BLOCKS
"FB_CYCLE_TIME" (FB153) / "DB_CYCLE_TIME" (DB153)
Cycle time acquisition
Additional blocks (not with units)
"FB_TOOL_LIFETIME" (FB151) / "DB_TOOL_LIFETIME" (DB151)
Management, tool lifetime
"FB_WORKPIECE_COUNTER" (FB152) / "DB_WORKPIECE_COUNTER" (DB152)
Piece counting
FC59 SUPPLY SCREENS TO HMI
"FC_DEC_HMI" (FC62)
Supplying HMI screens by user interface of the DB 59
FC159 SUPPLY SCREENS TO HMI

Part 6



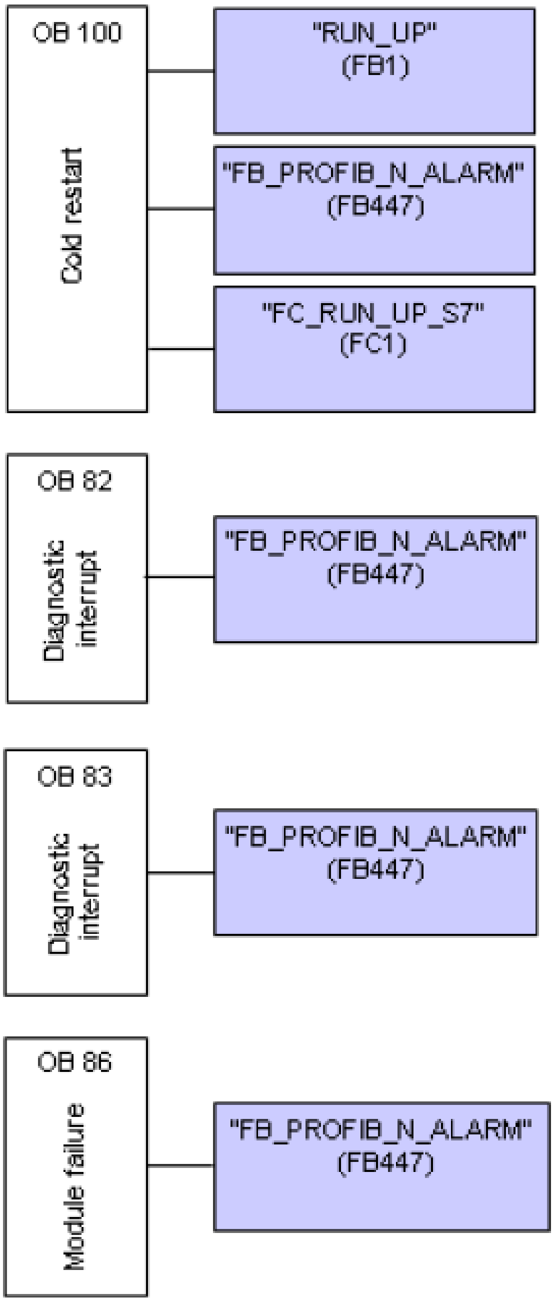
OB 1
FB 81 / DB81 MANAGEMENT MOBY-I/RF300
FB82 COMMUNICATION MOBY-I/RF300
"FC_MOBY_ASM450" (FC82)
"FC_MOBY_ASM450_CP" (FC83)
"FC_MOBY_ASM473" (FC84)
Dependent on the used identification system. Must be modified by the machine manufacturer. Suggestion for MOBY-I/RF300
FC149 Protective door
FC155 Error messages to DB2
"AL_MSG" (FC10) / "SIN_ALARM_SERVER" (DB2)
Sending alarms and messages to the alarm server for SINUMERIK
FC109 Error messages
Error messages to OP17/TP170, etc.

Part 7



OB 1
FC91 MANAGEMENT CBA SEND
"DB_CBA_SEND" (DB91)

Part 8


OB 100
Cold restart
"RUN_UP"
(FB1)
FB1 from
TRANSLINE library
"FB_PROFIB_N_ALARM"
(FB447)
"FC_RUN_UP_S7"
(FC1)
When using DB2 alarms:
FC1 from TRANSLINE
library
OB 82
Diagnostic
interrupt
"FB_PROFIB_N_ALARM"
(FB447)
OB 83
Diagnostic
interrupt
"FB_PROFIB_N_ALARM"
(FB447)
OB 86
Module failure
"FB_PROFIB_N_ALARM"
(FB447)

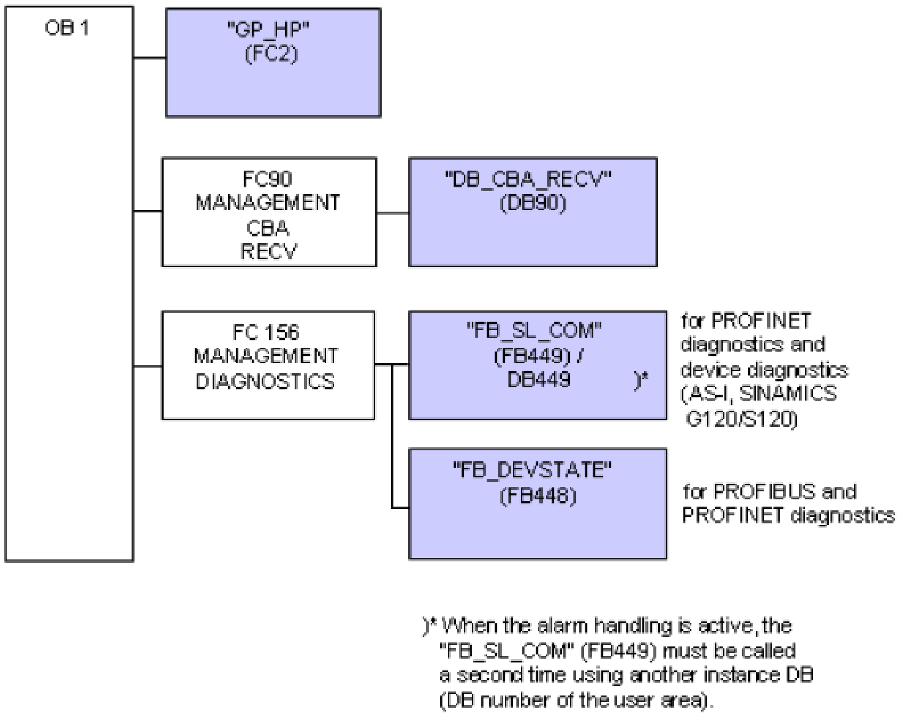
6.4.3.2 SINUMERIK 840D sl control

The blocks depicted in the program structure have the following meanings:

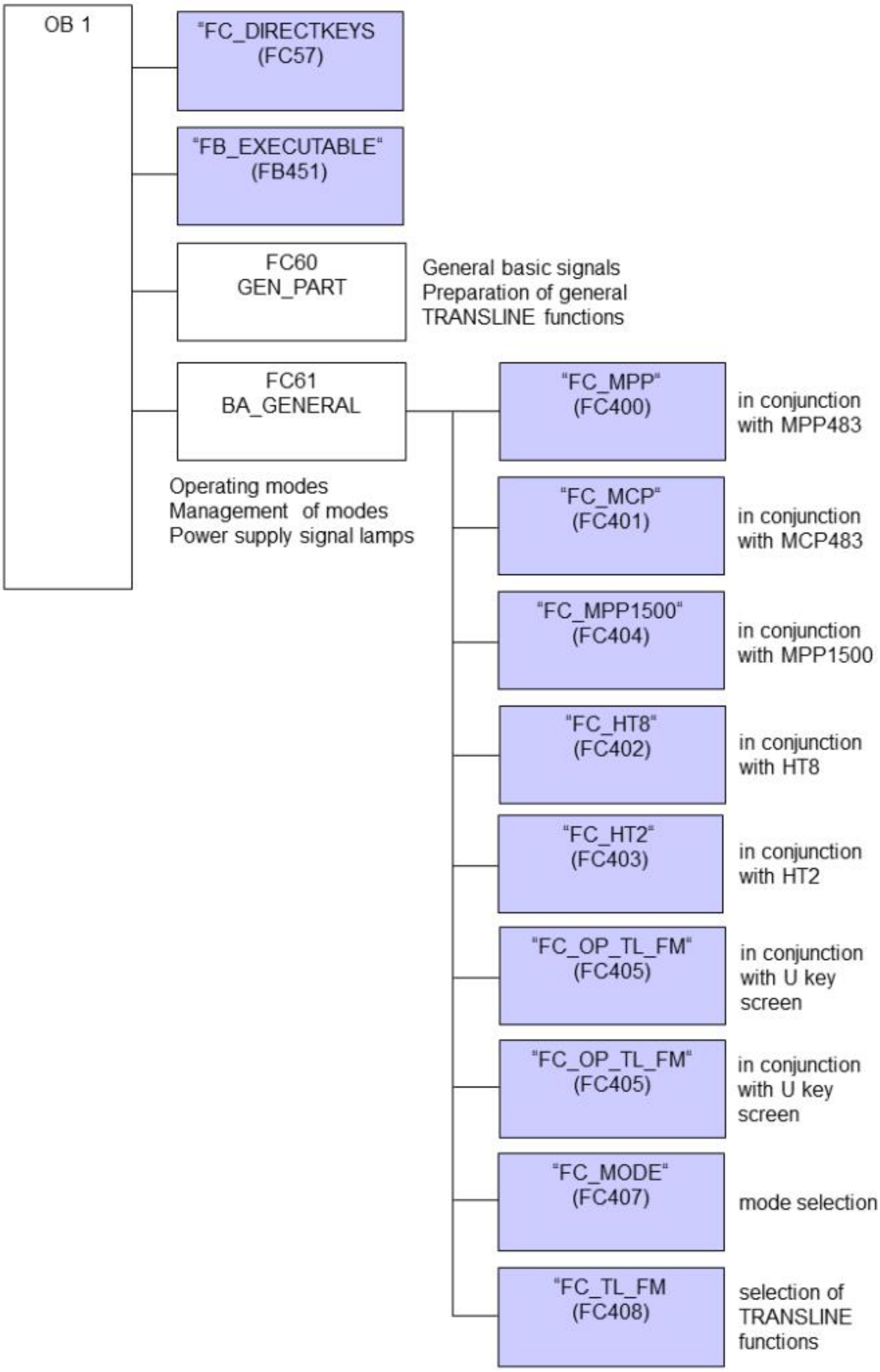
- Box with white background: Blocks must be supplemented or created by the user.
- Box with gray background: Standard blocks for TRANSLINE projects.

The background color relates to the OB/FB/FC type. The associated DBs may have to be adapted by the user.

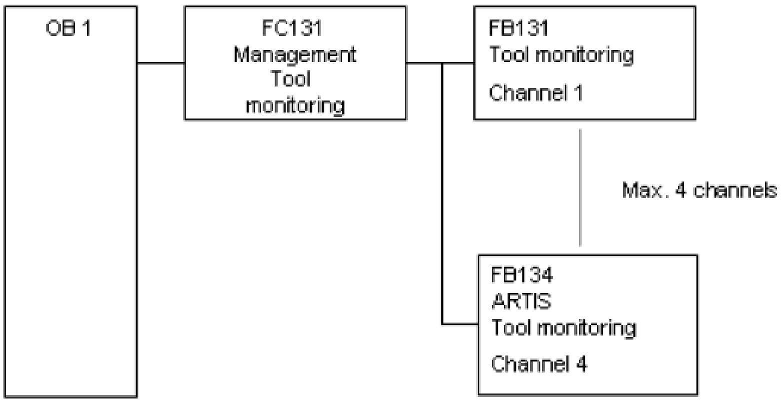
Part 1



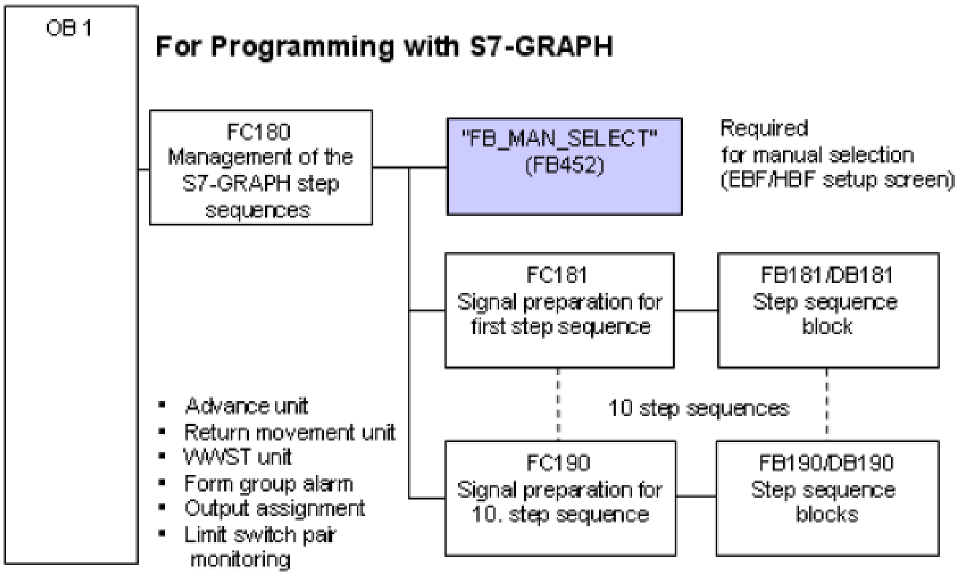
Part 2


OB 1
"FC_DIRECTKEYS
(FC57)
"FB_EXECUTABLE"
(FB451)
FC60
GEN_PART
General basic signals
Preparation of general
TRANSLINE functions
FC61
BA_GENERAL
Operating modes
Management of modes
Power supply signal lamps
"FC_MPP"
(FC400)
in conjunction
with MPP483
"FC_MCP"
(FC401)
in conjunction
with MCP483
"FC_MPP1500"
(FC404)
in conjunction
with MPP1500
"FC_HT8"
(FC402)
in conjunction
with HT8
"FC_HT2"
(FC403)
in conjunction
with HT2
"FC_OP_TL_FM"
(FC405)
in conjunction
with U key
screen
"FC_OP_TL_FM"
(FC405)
in conjunction
with U key
screen
"FC_MODE"
(FC407)
mode selection
"FC_TL_FM
(FC408)
selection of
TRANSLINE
functions

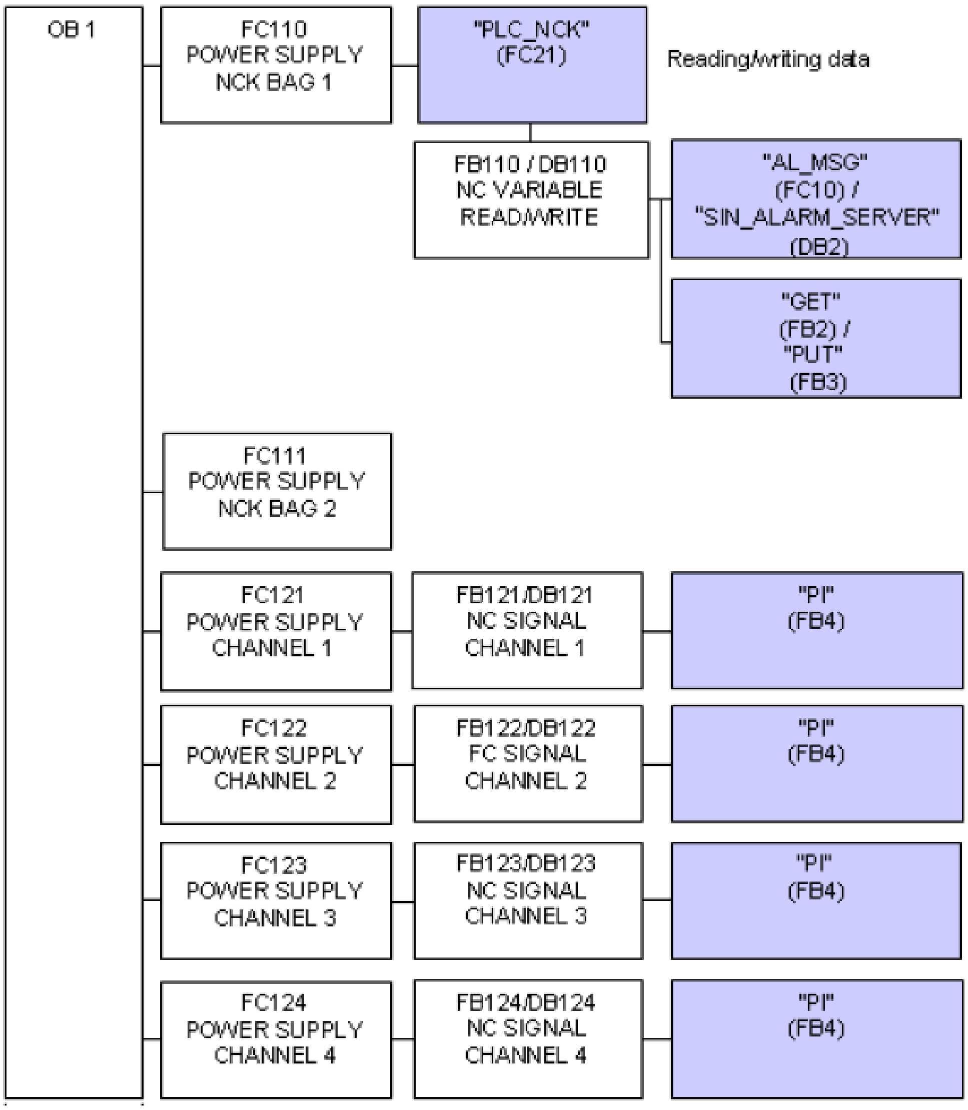
Part 3


OB 1
FC131
Management
Tool
monitoring
FB131
Tool monitoring
Channel 1
Max. 4 channels
FB134
ARTIS
Tool monitoring
Channel 4

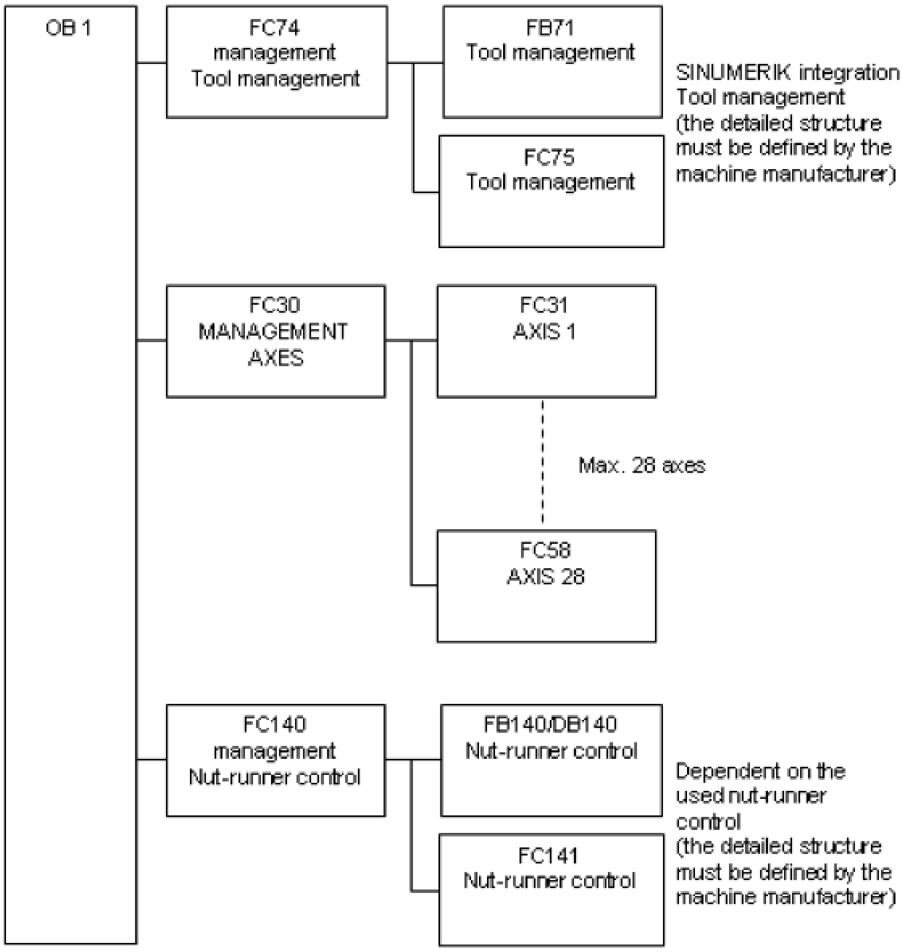
Part 4


OB 1
For Programming with S7-GRAPH
FC180
Management of the
S7-GRAPH step
sequences
"FB_MAN_SELECT"
(FB452)
Required
for manual selection
(EBF/HBF setup screen)
FC181
Signal preparation for
first step sequence
FB181/DB181
Step sequence
block
10 step sequences
FC190
Signal preparation for
10. step sequence
FB190/DB190
Step sequence
blocks
Advance unit
Return movement unit
VWST unit
Form group alarm
Output assignment
Limit switch pair
monitoring

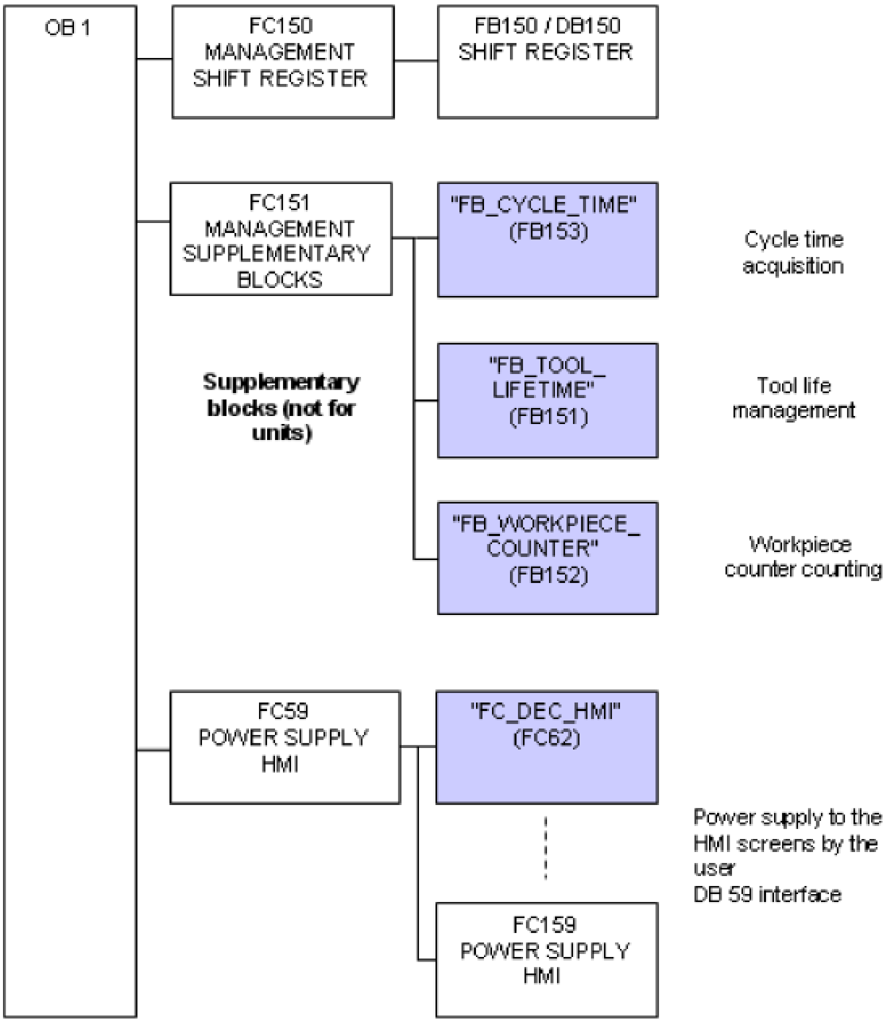
Part 5


OB 1
FC110
POWER SUPPLY
NCK BAG 1
"PLC_NCK"
(FC21)
Reading/writing data
FB110 / DB110
NC VARIABLE
READ/WRITE
"AL_MSG"
(FC10) /
"SIN_ALARM_SERVER"
(DB2)
"GET"
(FB2) /
"PUT"
(FB3)
FC111
POWER SUPPLY
NCK BAG 2
FC121
POWER SUPPLY
CHANNEL 1
FB121/DB121
NC SIGNAL
CHANNEL 1
"PI"
(FB4)
FC122
POWER SUPPLY
CHANNEL 2
FB122/DB122
FC SIGNAL
CHANNEL 2
"PI"
(FB4)
FC123
POWER SUPPLY
CHANNEL 3
FB123/DB123
NC SIGNAL
CHANNEL 3
"PI"
(FB4)
FC124
POWER SUPPLY
CHANNEL 4
FB124/DB124
NC SIGNAL
CHANNEL 4
"PI"
(FB4)

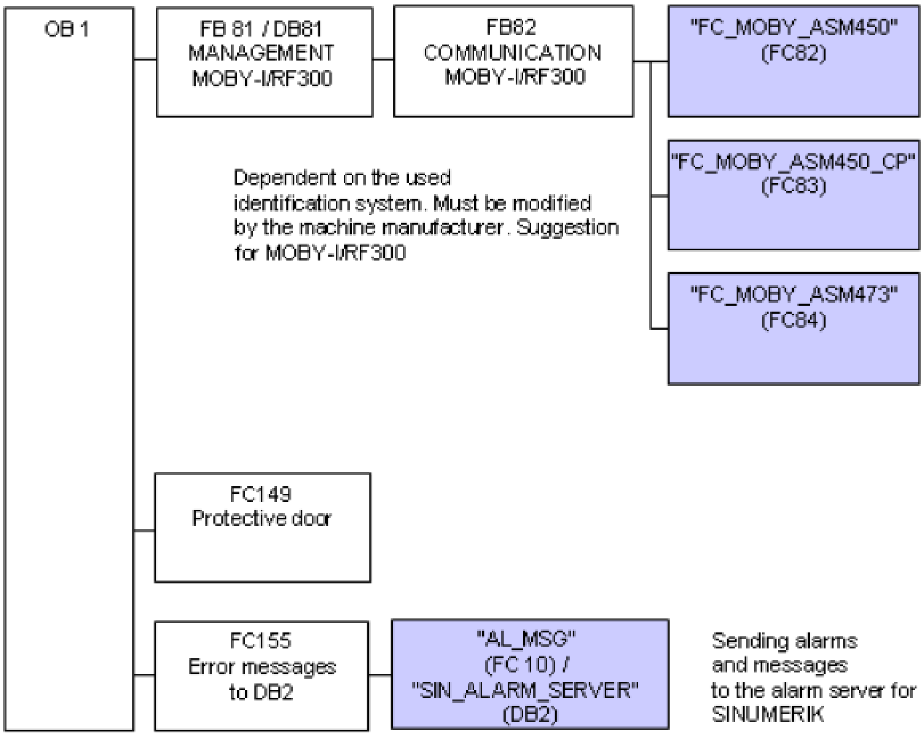
Part 6


OB 1
FC74
management
Tool management
FB71
Tool management
FC75
Tool management
SINUMERIK integration
Tool management
(the detailed structure
must be defined by the
machine manufacturer)
FC30
MANAGEMENT
AXES
FC31
AXIS 1
Max. 28 axes
FC58
AXIS 28
FC140
management
Nut-runner control
FB140/DB140
Nut-runner control
FC141
Nut-runner control
Dependent on the
used nut-runner
control
(the detailed structure
must be defined by the
machine manufacturer)

Part 7


OB 1
FC150 MANAGEMENT SHIFT REGISTER
FB150 / DB150 SHIFT REGISTER
FC151 MANAGEMENT SUPPLEMENTARY BLOCKS
"FB_CYCLE_TIME" (FB153)
Cycle time acquisition
Supplementary blocks (not for units)
"FB_TOOL_ LIFETIME" (FB151)
Tool life management
"FB_WORKPIECE_ COUNTER" (FB152)
Workpiece counter counting
FC59 POWER SUPPLY HMI
"FC_DEC_HMI" (FC62)
Power supply to the HMI screens by the user
DB 59 interface
FC159 POWER SUPPLY HMI

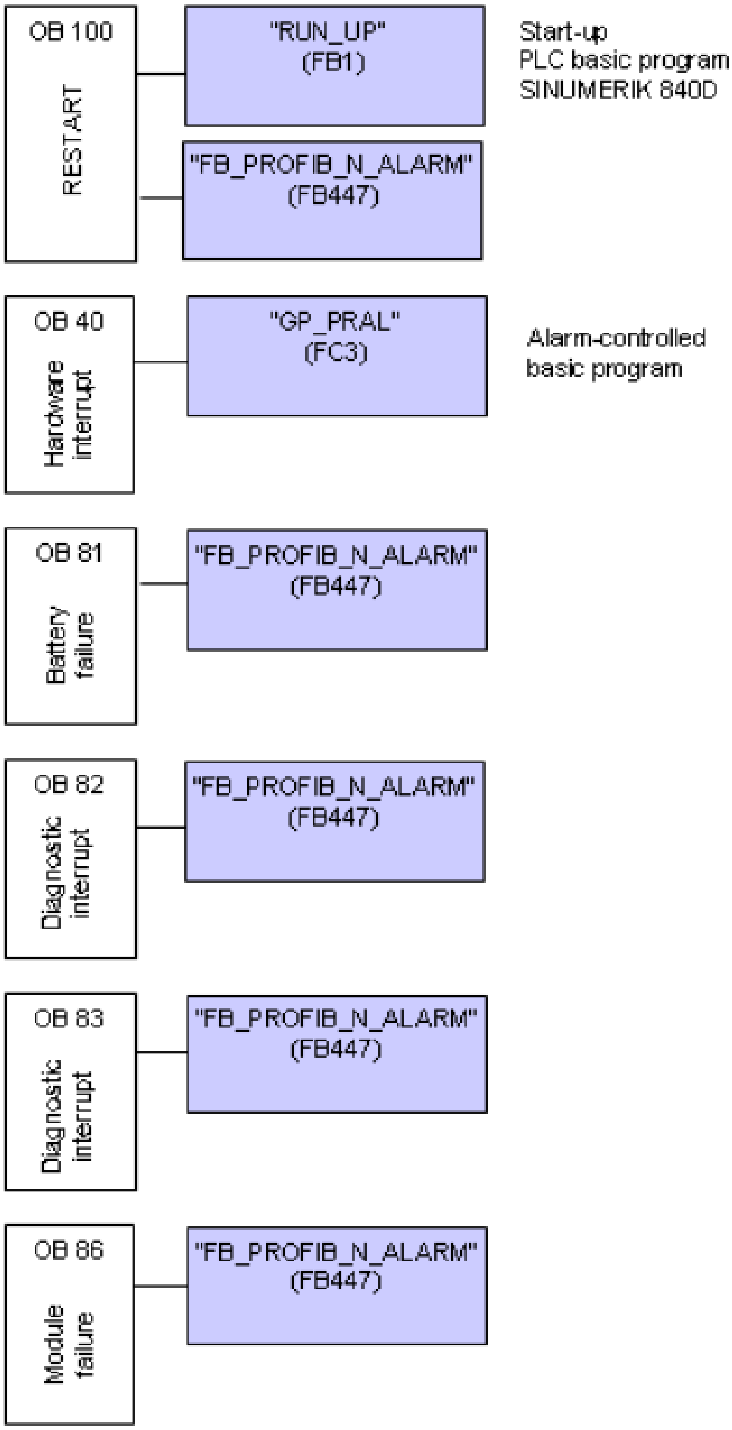
Part 8


OB 1
FB 81 / DB81
MANAGEMENT
MOBY-I/RF300
FB82
COMMUNICATION
MOBY-I/RF300
"FC_MOBY_ASM450"
(FC82)
"FC_MOBY_ASM450_CP"
(FC83)
"FC_MOBY_ASM473"
(FC84)
Dependent on the used identification system. Must be modified by the machine manufacturer. Suggestion for MOBY-I/RF300
FC149
Protective door
FC155
Error messages
to DB2
"AL_MSG"
(FC 10) /
"SIN_ALARM_SERVER"
(DB2)
Sending alarms and messages to the alarm server for SINUMERIK

Part 9


OB 1
FC91
MANAGEMENT
CBA
SEND
"DB_CBA_SEND"
(DB91)

Part 10



6.4.4 Modes of safe operation

TRANSLINE does not support any safe blocks. The blocks for recording the operator panels MPP, MCP, HT8 and HT2 and the signal-processing blocks FC_MODE, FC_TL_FM and FC_NC_FM support the OEM in the application of safe operating modes.

During the switchover of the safe operating modes, the bits for the TRANSLINE functional modes are set for the user, i.e. interlinked mode (automatic) (AUT), single mode (SM), single step mode (SSM), and setup mode (SET).

Function switchover to TRANSLINE in the direction of NC

Procedure:

- Bit monitoring
  DB_HMI.automaticmode (DB59.dbx76.1)
  DB_HMI.singlemode (DB59.dbx76.2)
  DB_HMI.singlestep (DB59.dbx76.3)
  DB_HMI.setupmode (DB59.dbx76.4)
- Response
  - With a change of state between (the TRANSLINE function modes)
    DB_HMI.automaticmode (DB59.dbx76.1)
    DB_HMI.singlemode (DB59.dbx76.2)
    DB_HMI.singlestep (DB59.dbx76.3)
    the mode can be switched over to the new TRANSLINE function mode without a response in the NC direction. You only have to make sure of the following:
    - DB_HMI.automaticmode_rm (DB59.dbx86.1) A restart is not required
    - DB_HMI.singlemode_rm (DB59.dbx86.2) The user must activate start on the next workpiece
    - DB_HMI.singlestep_rm (DB59.dbx86.3) The user must activate start after each NC block
- With the change of state from
  DB_HMI.automaticmode (DB59.dbx76.1)
  DB_HMI.singlemode (DB59.dbx76.2)
  DB_HMI.singlestep (DB59.dbx76.3)
  to
  DB_HMI.setupmode (DB59.dbx76.4)
  the function type can only be switched over, if, for example, the signal for all channels in reset has the value TRUE, or all of the channels in the mode group (BAG) signal disconnected.
  Example:
  A DB_HMI.setupmode (DB59.dbx76.4)
  A DB11.DBX6.7 // all channels in this mode group in reset
  = DB_HMI.setupmode (DB59.dbx86.4)
- With the change of state from
  DB_HMI.setupmode (DB59.dbx76.4)
  to
  DB_HMI.automaticmode (DB59.dbx76.1)
  DB_HMI.singlemode (DB59.dbx76.2)
  DB_HMI.singlestep (DB59.dbx76.3)
  there are no switchover restrictions from the TRANSLINE viewpoint.

6.4.4.1 Required control blocks

HMI PRO sl on a SIMATIC PLC via the PN interface

1. FB1 with instance data block 7 is called from the TRANSLINE block library in OB100. The input and output parameters must be specified for the connected machine control panels or the HT8.

   Program example for HT8 and MPP/MCP:
   CALL "FB_RUN","gp_par"
   MCPNum :=2
   MCP1In :=P#I0.0 //HT8 including direct keys
   MCP1Out :=P#Q0.0

MCP1StatSend
MCP1StatRec
MCP1BusAdr
MCP1Timeout
MCP1Cycl
...
MCP2In :=P#I64.0 //MPP483 IE, Adoption of
MCP2Out :=P#Q64.0 //PN-IO component
MCP2StatSen
…

2. The following are used:
   • FC_MPP (FC400) for connection of an MPP483
   • FC_MCP (FC401) for connection of an MCP483
   • FC_MPP1500 (FC404) for connection of an MPP1500
   • FC_HT8 (FC402) for connection of an HT8
   • FC_OP_TL_FM (FC405) for connection of a U key image (not HT8)

   The following are used:
   • FC_MODE (FC407) for the mode selection
   • FC_TL_FM (FC408) for the TRANSLINE function selection

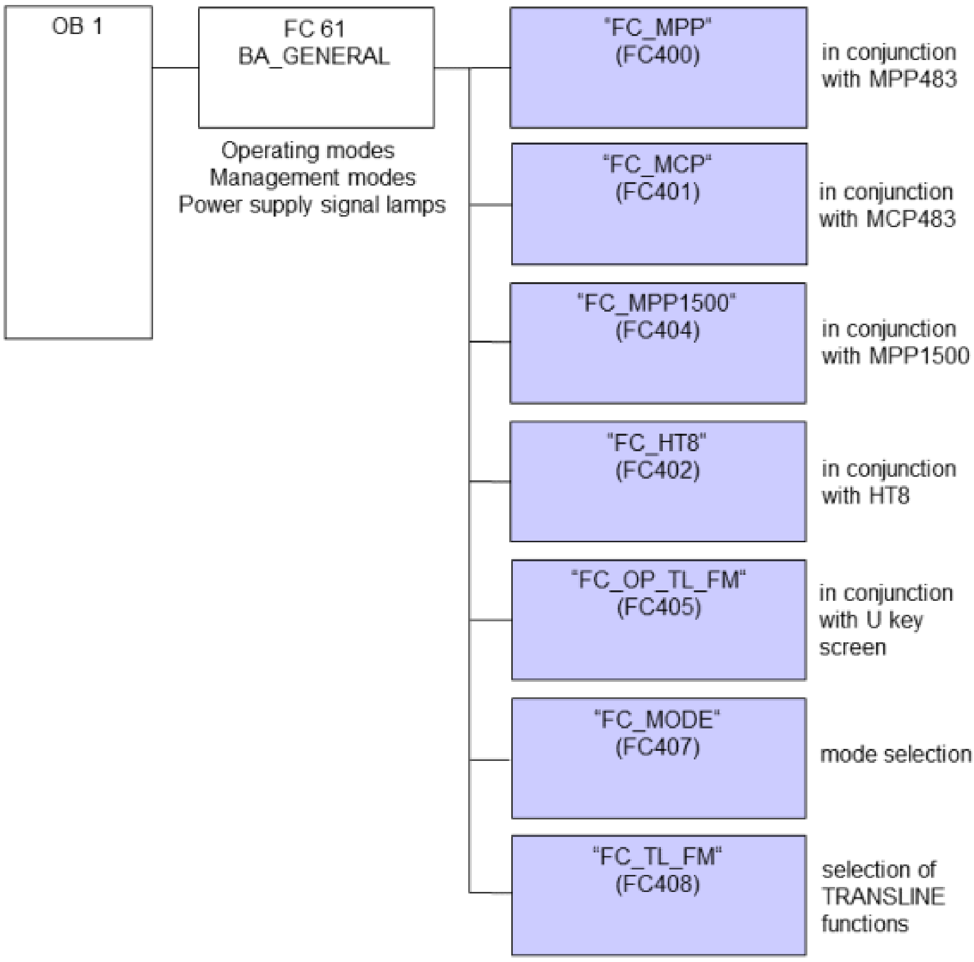


Fig. 43: Program structure when using an MCP483, MPP483, MPP1500, or HT8 on a SIMATIC PLC

HMI PRO sl on a SINUMERIK control

1. FB1 with instance data block 7 is called from the PLC program basic system of the NCU in OB100. The input/output parameters must be specified for the connected machine control panels or the HT8. The input/output parameters are also specified here for the direct keys of an OP08T, OP012 with TCU box and the OP15T.
2. The following are used:
   - FC_MPP (FC400) for connection of an MPP483
   - FC_MCP (FC401) for connection of an MCP483
   - FC_MPP1500 (FC404) for connection of an MPP1500
   - FC_HT8 (FC402) for connection of an HT8
   - FC_HT2 (FC403) for connection of an HT2
   - FC_OP_TL_FM (FC405) for connection of a U key image (not HT8)

The following are used:

- FC_MODE (FC407) for the mode selection
- FC_TL_FM (FC408) for the TRANSLINE function selection
- FC_NC_FM (FC409) for selection of NC functions

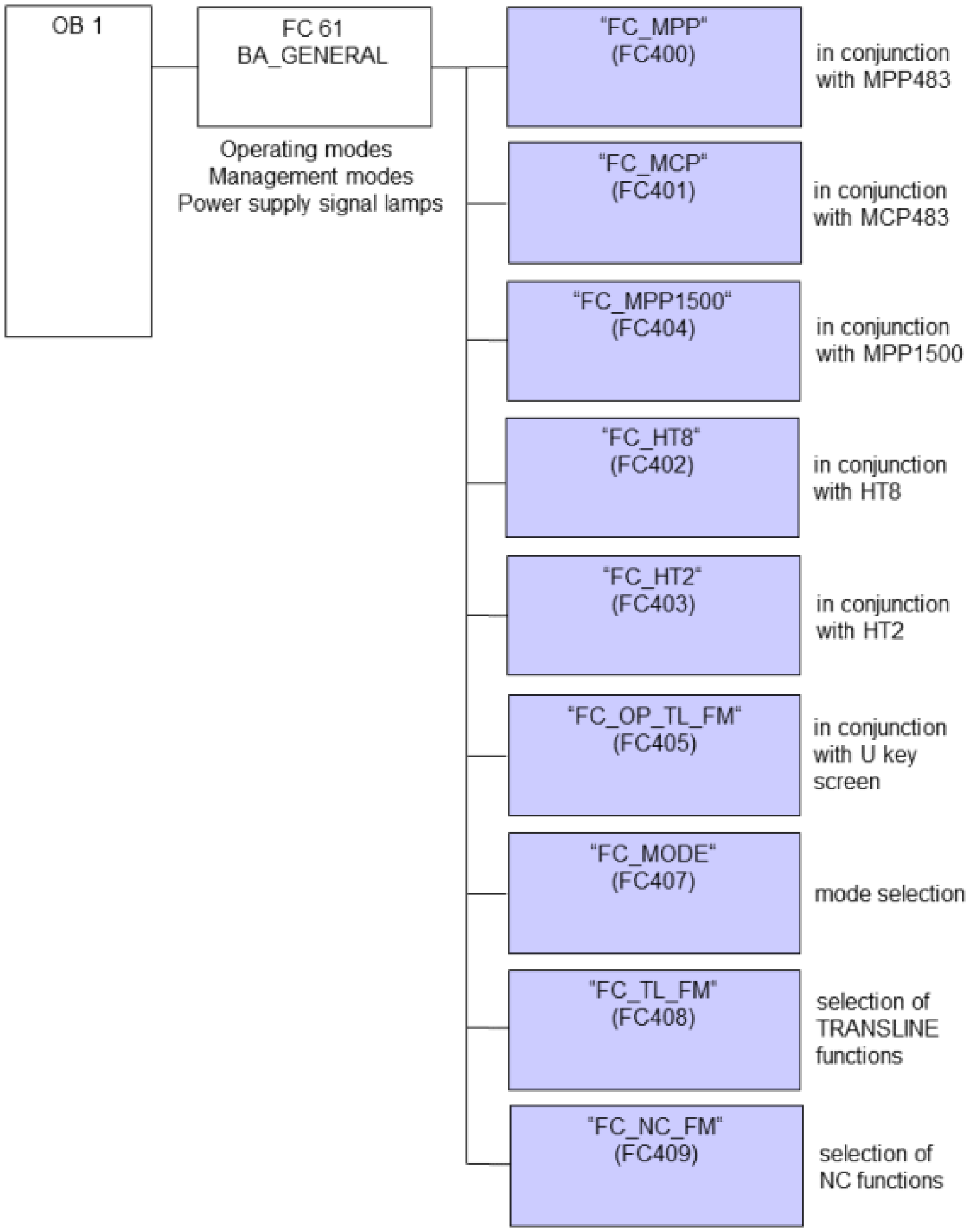


Fig. 44: Program structure when using an MCP483, MPP483, MPP1500, HT8 or HT2 on a SINUMERIK control

6.4.4.2 General information on the operating mode blocks

Block definitions

The operating mode blocks provide a similar interface for each operator device for the following keys and LEDs: MPP; MCP, axis selection keys and LEDs and keys/LEDs that are freely usable for the OEM.

There is an FC and parameterization data block for each operator device. The shared interface is the DB_DEVICE_INTERFACE.

The operating mode blocks FC_MPP, FC_MCP, FC_MPP1500, FC_HT8, FC_HT2, FC_OP_TL_FM, FC_MODE, FC_TL_FM, and FC_NC_FM replace the previous blocks FC_MCP_TLBA, FC_MCP, FC_MSTT_MPP, FC_MSTT_SCHNITTST, FC_MSTT_HT8, and FC_HT8_TLBA.

The assignment of the keys to TL and NC functions is defined in each case for the associated parameterization data block.

Address	Name	Type	Initial	Comment
0.0		STRUCT		
+0.0	parameterization_inputs	STRUCT		Parameterization of inputs
+0.0	mpp_component	STRUCT		MPP component
+0.0	machine_on	STRING[4]	'S1'	Transline function machine ON/control voltage ON
+6.0	machine_off	STRING[4]	'S7'	Transline function machine OFF/control voltage OFF
+12.0	media_on	STRING[4]	''	Transline function media ON
+18.0	media_off	STRING[4]	''	Transline function media OFF
+24.0	initial_state	STRING[4]	'S2'	Transline function initial state
+30.0	start_jog	STRING[4]	'S3'	Transline function start/jog single-step
+36.0	acknowledge_fault	STRING[4]	'S4'	Transline function acknowledge fault
+42.0	fault_will_be_corrected	STRING[4]	'F19'	message to Transline Collect/VW Master Interface/Prisma
+48.0	all_units_back	STRING[4]	''	Transline function all units back
+54.0	stop_after_end_of_cycle	STRING[4]	'S8'	Transline function function stop after end of cycle
+60.0	immediate_stop	STRING[4]	'S9'	Transline function immediate stop/feed stop
+66.0	lock_rel_protect_doors	STRING[4]	'S10'	Transline function lock/release protective doors
+72.0	emergency_stop	STRING[4]	''	emergency stop
+78.0	automatic_mode	STRING[4]	'F1'	Transline function automatic mode AUT
+84.0	single_mode	STRING[4]	'F6'	Transline function single mode SM
+90.0	single_step_mode	STRING[4]	'F11'	Transline function single-step mode SSM
+96.0	setup_mode	STRING[4]	'F16'	Transline function setup mode SET
+102.0	reserve_MPP	ARRAY[1..13]		reserve
*6.0		STRING[4]		
=180.0		END_STRUCT		
+180.0	mcp_component	STRUCT		MCP component
+0.0	auto	STRING[4]	'F2'	NC function AUTO
+6.0	mda	STRING[4]	'F7'	NC function MDA
+12.0	teach	STRING[4]	''	NC function TEACH
+18.0	jog	STRING[4]	'F12'	NC function JOG
+24.0	single_block	STRING[4]	'F3'	NC function SINGLE BLOCK
+30.0	inc_1	STRING[4]	''	NC function increment 1
+36.0	inc_10	STRING[4]	''	NC function increment 10

Fig. 45: Example section DB_MPP: Assignment of the keys to the functions

6.4.4.3 FC_MPP (FC400)

When creating the START signal, the FC_MPP reads the assignment of the keys from the DB_MPP once, calculates the new addresses and enters them in the assigned data block.

This FC forwards all key signals to the DB_DEVICE_INTERFACE, parameterization_inputs area, as long as the RLO 1 is present at the input parameter ENABLE. It is possible to forward selected keys to the DB_DEVICE_INTERFACE even when no global release (ENABLE) is active. Release the corresponding signal in the always_enabled area for this purpose.

The lamps and LEDs are always read from the DB_DEVICE_INTERFACE area outputs_assigned and then displayed.

With the input parameter LAMPTEST = TRUE, all lamps and LEDs on the MPP483 are activated. If ENABLE RLO=0 is present at the input parameter, and an unreleased key in the DB_DEVICE_INTERFACE, always_enabled area, is pressed, all of the lamps and LEDs on the MPP483 are also activated.

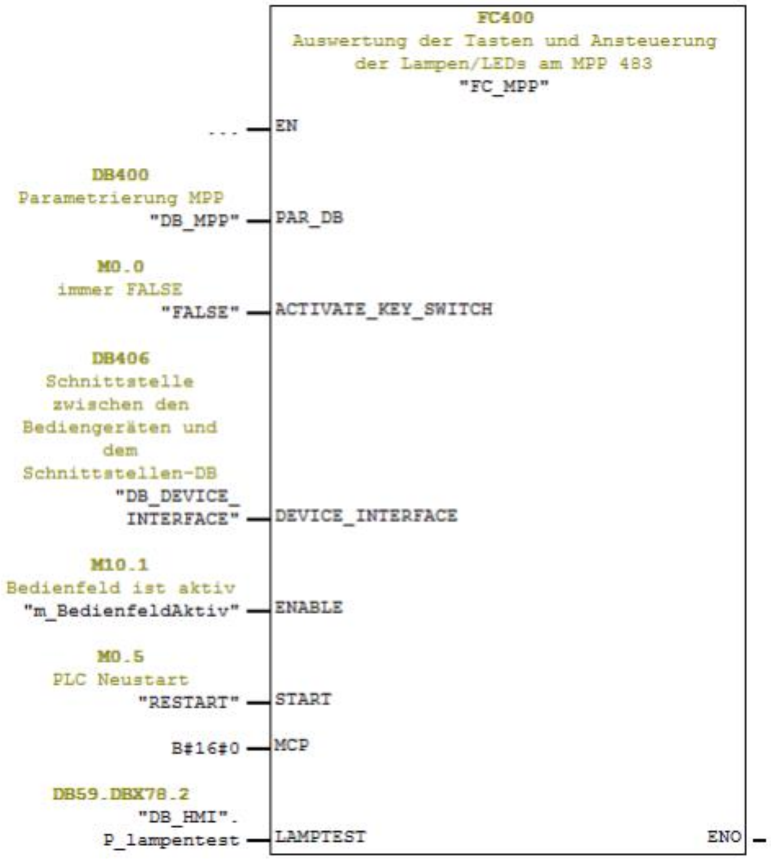


Fig. 46: FC_MPP (FC400)

Name	Data Type	Comment
PAR_DB	Block_DB	data block for parameterization of the MPP
ACTIVATE_KEY_SWITCH	Bool	keyswitch for the protection levels can be found on the MCP
DEVICE_INTERFACE	Block_DB	data block device interface
ENABLE	Bool	enable of the MPP483
START	Bool	first block cycle following CPU newstart
MCP	Byte	MPP is connected as MCPx, 0=MCP; 1=MCP2; 2=HHU interface
LAMPTEST	Bool	activates the lamps for test

Fig. 47: FC_MPP input parameter

Description of input parameters

Parameter	Data type	Description
PAR_DB	BLOCK_DB	Data block for parameterizing the pushbuttons and function keys on the MPP483. This is DB_MPP (DB400) as the default setting.
ACTIVAT_KEY_SWITCH	BOOL	TRUE = MPP has a keyswitch for protection levels 4-7 (keyswitch position 0-3)
DEVICE_INTERFACE	BLOCK_DB	The interface between the operator devices and the blocks for acquiring the operating modes, TRANSLINE functions and NC functions. This is DB_DEVICE_INTERFACE (DB406) as the default setting.
ENABLE	BOOL	Global release for reading in the function and key signals of the MPP483.
START	BOOL	First block cycle following a CPU restart. This must be done after every reparameterization of the key interface in DB_MPP (DB400). The m_restart (M0.5) bit memory in accordance with the TRANSLINE standard is specified here.
MCP	BYTE	B#16#0 The MPP483 is connected as first machine control panel. (addressing: OB100 → FB1, parameters begin with MCP1) B#16#1 The MPP483 is connected as second machine control panel (addressing: OB100 → FB1, parameters begin with MCP2) B#16#2 The MPP483 is connected as HHU parameterized machine control panel (addressing: OB100 → FB1, parameters begin with HHU)
LAMPTEST	BOOL	All outputs (lamps and LEDs) are activated with this signal.

Table 15: Input parameter FC_MPP

Data interface

GP_PAR → DB7

BLOCK_DB

Instance data block of the function block RUN_UP (FB1). These blocks are transferred for an NC version from the NC base program.

Dependencies

The FC_MPP depends on the base program of the NC and on the interface of the MPP483 to the PLC. It requires HMI PRO sl Version >= 04.05.03.09.

DB_MPP (DB400): Parameterizing the keys of the MPP483

The keys, lamps and LEDs are assigned via the DB_MPP. Function keys are identified with F, pushbuttons with S, LEDs with HF and lamps with HS.

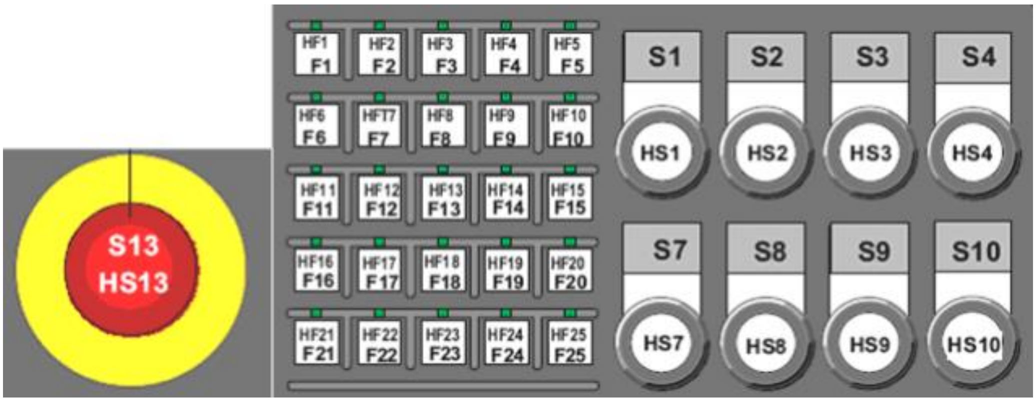


Fig. 48: Keys, lamps, and LEDs of an MPP483

Possible variables

Inputs: Parameterization_inputs area

Outputs: Parameterization_outputs area

mpp_component		
machine_on	String[4]	TRANSLINE function unit/machine on
machine_off	String[4]	TRANSLINE function unit/machine off
media_on	String[4]	TRANSLINE function media on
media_off	String[4]	TRANSLINE function media off
initial_state	String[4]	TRANSLINE function initial state
start_jog	String[4]	TRANSLINE function start/jog single step
acknowledge_fault	String[4]	TRANSLINE function acknowledge fault
fault_will_be_corrected	String[4]	Message to TRANSLINE Collect/VW Master Interface/ PRISMA
all_units_back	String[4]	TRANSLINE function all units back
stop_after_end_of_cycle	String[4]	TRANSLINE function stop after end of cycle
immediate_stop	String[4]	TRANSLINE function immediate stop
lock_rel_protect_doors	String[4]	TRANSLINE function lock/release protective doors
emergency_stop	String[4]	Emergency Stop
automatic_mode	String[4]	TRANSLINE function automatic mode AUT (interlinked)
single_mode	String[4]	TRANSLINE function single mode SM
single_step_mode	String[4]	TRANSLINE function single step mode SSM
setup_mode	String[4]	TRANSLINE function setup mode SET

mcp_component		
auto	String[4]	NC function AUTO
mda	String[4]	NC function MDA
teach	String[4]	NC function TEACH
jog	String[4]	NC function JOG
single_block	String[4]	NC function SINGLE BLOCK
inc_1	String[4]	NC function increment 1
inc_10	String[4]	NC function increment 10
inc_100	String[4]	NC function increment 100
inc_1000	String[4]	NC function increment 1000
inc_10000	String[4]	NC function increment 10000
inc_var	String[4]	NC function variable increments
goto_refpoint	String[4]	NC function goto reference point
repos	String[4]	NC function REPOS
nc_stop	String[4]	NC function NC STOP
nc_start	String[4]	NC function NC start
feed_stop	String[4]	NC function feed stop
feed_start	String[4]	NC function feed start
spindle_stop	String[4]	NC function spindle stop
spindle_start	String[4]	NC function spindle start
axis_selection_hmipro	String[4]	NC function axis selection screen HMI PRO
mcs_wcs	String[4]	NC function switchover request MCS/WCS
reset	String[4]	NC function reset
rapid	String[4]	NC function rapid traverse
motion_plus	String[4]	NC function motion plus direction
motion_minus	String[4]	NC function motion minus direction
axis		
axis 1	String[4]	NC function axis selection
…	…	…
axis31	String[4]	NC function axis selection
oem		
fct_1	String[4]	Unassigned function key for OEM
…	…	…
fct_100	String[4]	Unassigned function key for OEM

Table 16: parameterization_inputs / parameterization_outputs area

General release for acquisition of the keys

In the always_enabled area, individual keys can be enabled via a bit interface, despite the lack of a global release ENABLE. These individual releases are checked cyclically.

6.4.4.4 FC_MCP (FC401)

When creating the START signal, the FC_MCP reads once the assignment of the keys from the DB_MCP, calculates the new addresses and enters them in the assigned data block.

This FC forwards all key signals to the DB_DEVICE_INTERFACE, parameterization_inputs area, as long as the RLO 1 is present at the input parameter ENABLE. It is possible to forward selected keys to the DB_DEVICE_INTERFACE even when no release (ENABLE) is available. Release the corresponding signal in the always_enabled area for this purpose.

With the input parameter LAMPTEST = TRUE, all LEDs on the MCP483 are activated. If ENABLE RLO=0 is present at the input parameter, and an unreleased key in the DB_DEVICE_INTERFACE, always_enabled area, is pressed, all of the LEDs on the MCP483 are also activated.

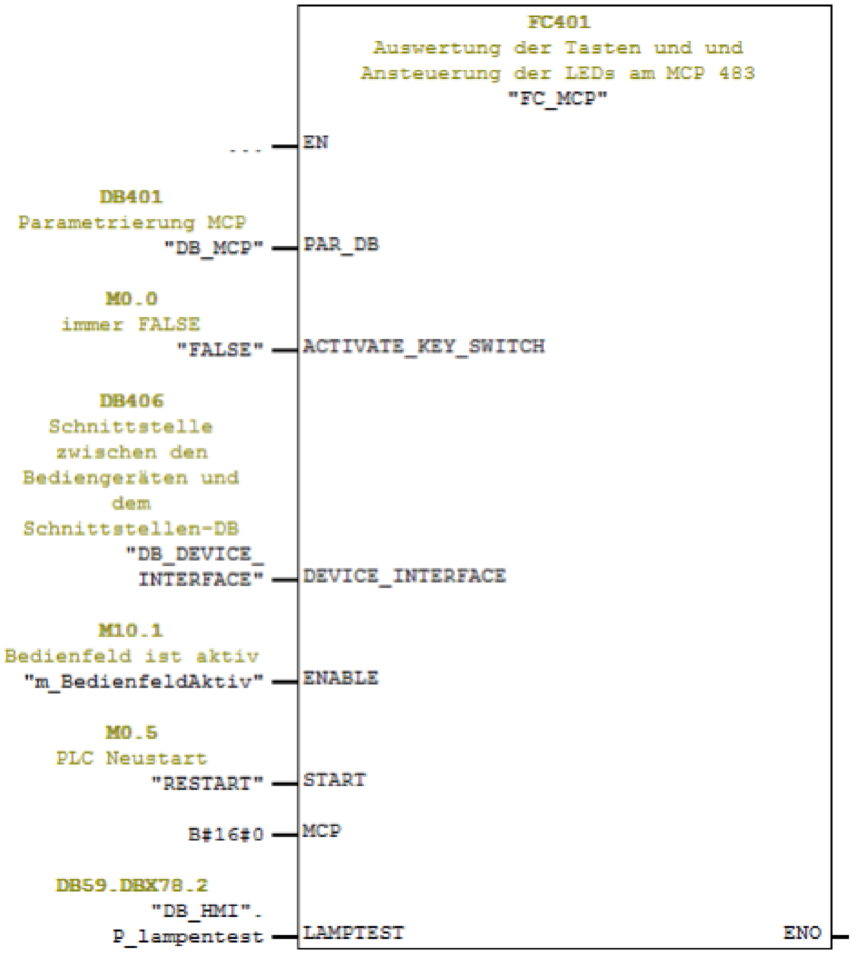


Fig. 49: FC_MCP (FC401)

Name	Data Type	Comment
PAR_DB	Block_DB	data block for parameterization of the MCP
ACTIVATE_KEY_SWITCH	Bool	keyswitch for the protection levels can be found on the MCP
DEVICE_INTERFACE	Block_DB	data block device interface
ENABLE	Bool	enable of the MCP483
START	Bool	first block cycle following CPU newstart
MCP	Byte	MPP is connected as MCPx, 0=MCP; 1=MCP2; 2=HHU interface
LAMPTEST	Bool	activates the lamps for test

Fig. 50: FC_MCP input parameter

Description of input parameters

Parameter	Data type	Description
PAR_DB	BLOCK_DB	Data block for parameterizing the pushbuttons and function keys on the MCP483. This is DB_MCP (DB401) as the default setting.
ACTIVAT_KEY_SWITCH	BOOL	TRUE = MPP has a keyswitch for protection levels 4-7 (keyswitch position 0-3)
DEVICE_INTERFACE	BLOCK_DB	The interface between the operator devices and the blocks for acquiring the operating modes, TRANSLINE functions and NC functions. This is DB_DEVICE_INTERFACE (DB406) as the default setting.
ENABLE	BOOL	Global release for reading in the function and key signals of the MCP483.
START	BOOL	First block cycle following a CPU restart. This must be done after every reparameterization of the key interface in DB_MCP (DB401). The m_restart (M0.5) bit memory in accordance with the TRANSLINE standard is specified here.
MCP	BYTE	B#16#0 The MCP483 is connected as first machine control panel. (addressing: OB100 → FB1, parameters begin with MCP1) B#16#1 The MCP483 is connected as second machine control panel (addressing: OB100 → FB1, parameters begin with MCP2) B#16#2 The MCP483 is connected as HHU parameterized machine control panel (addressing: OB100 → FB1, parameters begin with HHU)
LAMPTEST	BOOL	All outputs (lamps and LEDs) are activated with this signal.

Table 17: Input parameter FC_MCP

Data interface

GP_PAR → DB7

BLOCK_DB

Instance data block of the function block RUN_UP (FB1). These blocks are transferred for an NC version from the NC base program.

Dependencies

The FC_MCP depends on the base program of the NC and on the interface of the MCP483 to the PLC. It requires HMI PRO sl Version >= 04.05.03.09.

DB_MCP (DB401): Parameterizing the keys of the MCP483

The keys, lamps and LEDs are assigned via the DB_MCP. Function keys are designated with F, T or R, LEDs with HF, HT or HR.

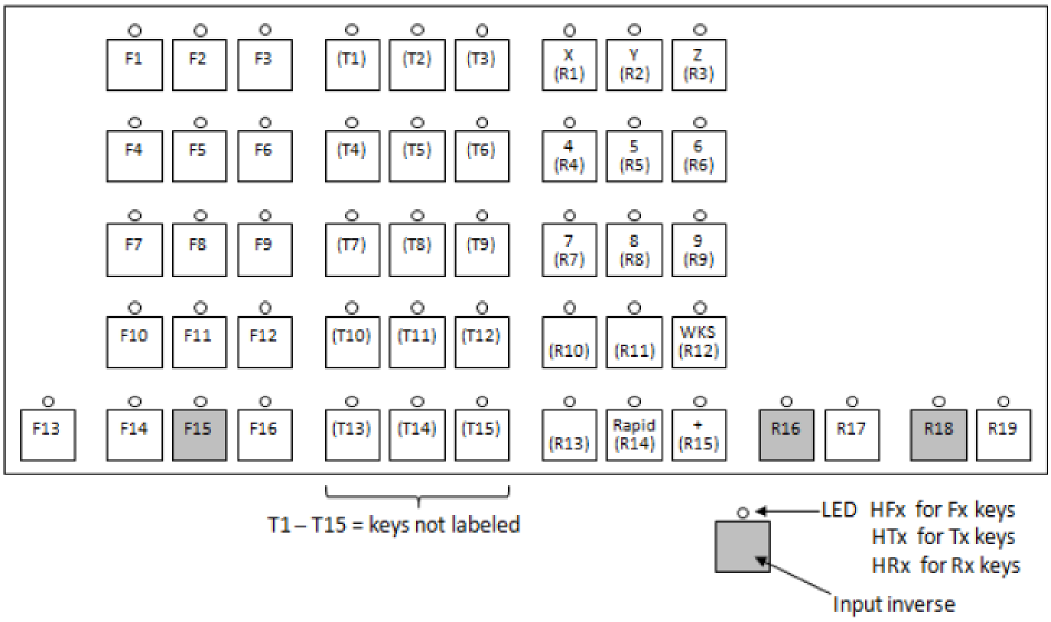


Fig. 51: Keys of an MCP483

Possible variables

Inputs: Parameterization_inputs area

Outputs: Parameterization_outputs area

mpp_component		
machine_on	String[4]	TRANSLINE function unit/machine on
machine_off	String[4]	TRANSLINE function unit/machine off
media_on	String[4]	TRANSLINE function media on
media_off	String[4]	TRANSLINE function media off
initial_state	String[4]	TRANSLINE function initial state
start_jog	String[4]	TRANSLINE function start/jog single step
acknowledge_fault	String[4]	TRANSLINE function acknowledge fault
fault_will_be_corrected	String[4]	Message to TRANSLINE Collect/VW Master Interface/ PRISMA
all_units_back	String[4]	TRANSLINE function all units back
stop_after_end_of_cycle	String[4]	TRANSLINE function stop after end of cycle
immediate_stop	String[4]	TRANSLINE function immediate stop
lock_rel_protect_doors	String[4]	TRANSLINE function lock/release protective doors
emergency_stop	String[4]	Emergency Stop
automatic_mode	String[4]	TRANSLINE function automatic mode AUT (interlinked)
single_mode	String[4]	TRANSLINE function single mode SM
single_step_mode	String[4]	TRANSLINE function single step mode SSM
setup_mode	String[4]	TRANSLINE function setup mode SET
mcp_component		
auto	String[4]	NC function AUTO
mda	String[4]	NC function MDA
teach	String[4]	NC function TEACH
jog	String[4]	NC function JOG
single_block	String[4]	NC function SINGLE BLOCK
inc_1	String[4]	NC function increment 1
inc_10	String[4]	NC function increment 10
inc_100	String[4]	NC function increment 100
inc_1000	String[4]	NC function increment 1000
inc_10000	String[4]	NC function increment 10000
inc_var	String[4]	NC function variable increments
goto_refpoint	String[4]	NC function goto reference point
repos	String[4]	NC function REPOS
nc_stop	String[4]	NC function NC STOP
nc_start	String[4]	NC function NC start
feed_stop	String[4]	NC function feed stop
feed_start	String[4]	NC function feed start
spindle_stop	String[4]	NC function spindle stop
spindle_start	String[4]	NC function spindle start
axis_selection_hmipro	String[4]	NC function axis selection screen HMI PRO
mcs_wcs	String[4]	NC function switchover request MCS/WCS
reset	String[4]	NC function reset
rapid	String[4]	NC function rapid traverse
motion_plus	String[4]	NC function motion plus direction
motion_minus	String[4]	NC function motion minus direction
axis		
axis 1	String[4]	NC function axis selection
…	…	…
axis31	String[4]	NC function axis selection

oem		
fct_1	String[4]	OEM function 1
…	…	…
fct_100	String[4]	OEM function

Table 18: FC_MCP parameterization_inputs / parameterization_outputs

General release for acquisition of the keys

In the always_enabled area, individual keys can be enabled via a bit interface, despite the lack of a global release ENABLE. These individual releases are checked cyclically.

6.4.4.5 FC_MPP1500 (FC404)

When creating the START signal, FC_MPP1500 reads once the assignment of the pushbuttons from DB_MPP1500, calculates the new addresses and enters them in the assigned data block.

This FC forwards all pushbutton signals to the DB_DEVICE_INTERFACE, parameterization_inputs area, as long as the RLO 1 is present at the input parameter ENABLE. It is possible to forward selected pushbuttons to the DB_DEVICE_INTERFACE even when no global release (ENABLE) is active. Release the corresponding signal in the always_enabled area for this purpose.

The LEDs (LED luminous rings) are always read from the DB_DEVICE_INTERFACE, outputs_assigned area, and then displayed.

With the input parameter LAMPTEST = TRUE, all LEDs on the MPP1500 are activated. If ENABLE RLO=0 is present at the input parameter, and an unreleased pushbutton in the DB_DEVICE_INTERFACE, always_enabled area, is pressed, all of the LEDs on the MPP1500 are also activated.

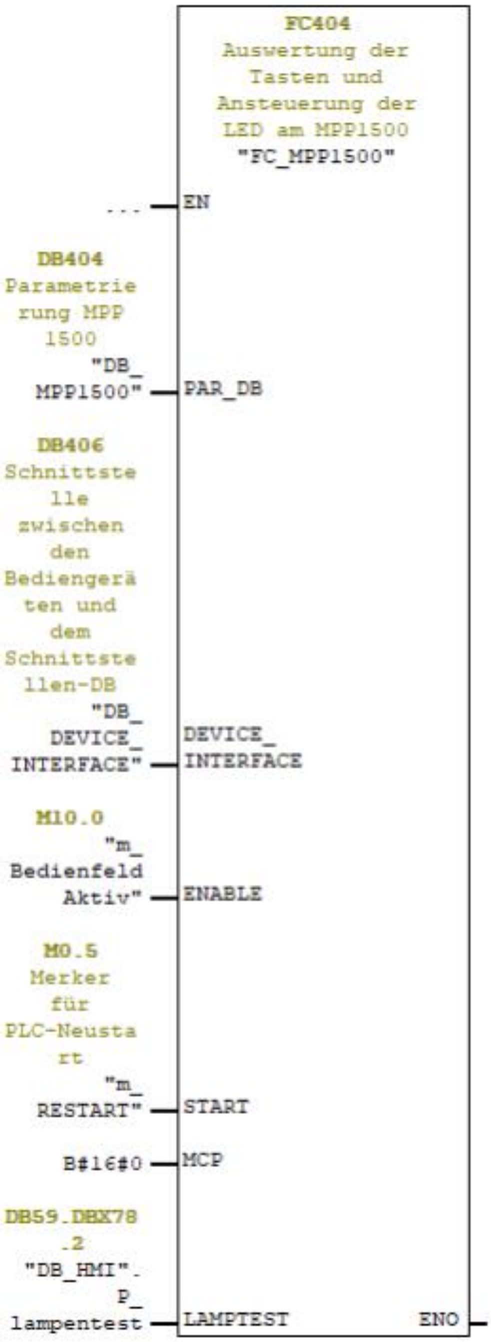


Fig. 52: FC_MPP1500 (FC404)

Name	Data Type	Comment
PAR_DB	Block_DB	data block for parameterization of the MPP1500
DEVICE_INTERFACE	Block_DB	data block device interface
ENABLE	Bool	enable of the MPP1500
START	Bool	first block cycle following CPU newstart
MCP	Byte	MPP is connected as MCPx, 0=MCP1; 1=MCP2; 2=HHU interface
LAMPTEST	Bool	activates the lamps for test

Fig. 53: FC_MPP1500 input parameter

Description of input parameters

Parameter	Data type	Description
PAR_DB	BLOCK_DB	Data block for parameterizing the pushbuttons and function keys on the MPP1500. This is DB_MPP1500 (DB404) as the default setting.
DEVICE_INTERFACE	BLOCK_DB	The interface between the operator devices and the blocks for acquiring the operating modes, TRANSLINE functions and NC functions. This is DB_DEVICE_INTERFACE (DB406) as the default setting.
ENABLE	BOOL	Global release for reading in the function and key signals of the MPP1500.
START	BOOL	First block cycle following a CPU restart. This must be done after every reparameterization of the key interface in DB_MPP1500 (DB404). The m_restart (M0.5) bit memory in accordance with the TRANSLINE standard is specified here.
MCP	BYTE	B#16#0 The MCP483 is connected as first machine control panel. (addressing: OB100 → FB1, parameters begin with MCP1) B#16#1 The MCP483 is connected as second machine control panel (addressing: OB100 → FB1, parameters begin with MCP2) B#16#2 The MCP483 is connected as HHU parameterized machine control panel (addressing: OB100 → FB1, parameters begin with HHU)
LAMPTEST	BOOL	All outputs (lamps and LEDs) are activated with this signal.

Table 19: Input parameter FC_MPP1500

Data interface

GP_PAR → DB7

BLOCK_DB

Instance data block of the function block RUN_UP (FB1). These blocks are transferred for an NC version from the NC base program.

Dependencies

The FC_MPP1500 depends on the base program of the NC and on the interface of the MPP1500 to the PLC. It requires HMI PRO sl Version >= 04.05.03.09.

DB_MPP1500 (DB404): Parameterizing the pushbuttons of the MPP1500)

The pushbuttons and LEDs are assigned via DB_MPP1500. Pushbuttons are identified by S, LEDs (LED luminous rings) by HS.

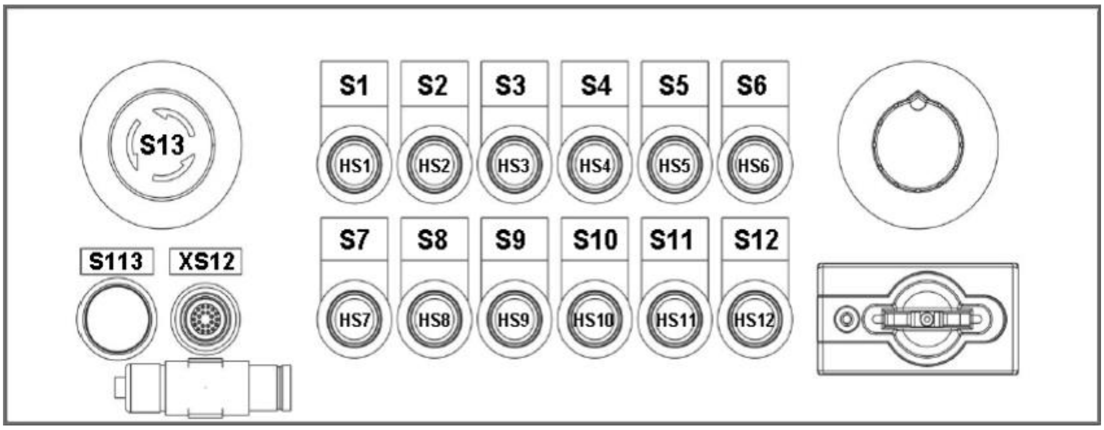


Fig. 54: Pushbuttons and LEDs (LED luminous rings) of an MPP1500

Possible variables

Inputs: Parameterization_inputs area

mppComponent		
machine_on	String[4]	TRANSLINE function unit/machine on
machine_off	String[4]	TRANSLINE function unit/machine off
media_on	String[4]	TRANSLINE function media on
media_off	String[4]	TRANSLINE function media off
initial_state	String[4]	TRANSLINE function initial state
start_jog	String[4]	TRANSLINE function start/jog single step
acknowledge_fault	String[4]	TRANSLINE function acknowledge fault
fault_will_be_corrected	String[4]	Message to TRANSLINE Collect/VW Master Interface/ PRISMA
all_units_back	String[4]	TRANSLINE function all units back
stop_after_end_of_cycle	String[4]	TRANSLINE function stop after end of cycle
immediate_stop	String[4]	TRANSLINE function immediate stop
lock_rel_protect_doors	String[4]	TRANSLINE function lock/release protective doors
emergency_stop	String[4]	Emergency Stop
automatic_mode	String[4]	TRANSLINE function automatic mode AUT (interlinked)
single_mode	String[4]	TRANSLINE function single mode SM
single_step_mode	String[4]	TRANSLINE function single step mode SSM
setup_mode	String[4]	TRANSLINE function setup mode SET
mcpComponent		
auto	String[4]	NC function AUTO
mda	String[4]	NC function MDA
teach	String[4]	NC function TEACH
jog	String[4]	NC function JOG
single_block	String[4]	NC function SINGLE BLOCK
inc_1	String[4]	NC function increment 1
inc_10	String[4]	NC function increment 10
inc_100	String[4]	NC function increment 100
inc_1000	String[4]	NC function increment 1000
inc_10000	String[4]	NC function increment 10000
inc_var	String[4]	NC function variable increments
goto_refpoint	String[4]	NC function goto reference point
repos	String[4]	NC function REPOS
nc_stop	String[4]	NC function NC STOP
nc_start	String[4]	NC function NC start
feed_stop	String[4]	NC function feed stop
feed_start	String[4]	NC function feed start
spindle_stop	String[4]	NC function spindle stop
spindle_start	String[4]	NC function spindle start
axis_selection_hmipro	String[4]	NC function axis selection screen HMI PRO
mcs_wcs	String[4]	NC function switchover request MCS/WCS
reset	String[4]	NC function reset
rapid	String[4]	NC function rapid traverse
motion_plus	String[4]	NC function motion plus direction
motion_minus	String[4]	NC function motion minus direction
axis		
axis 1	String[4]	NC function axis selection
…	…	…
axis31	String[4]	NC function axis selection
oem		

fct_1	String[4]	Unassigned function key for OEM
…	…	…
fct_100	String[4]	Unassigned function key for OEM

Table 20: MPP1500 - parameterizationInputs / parameterizationOutputs area

Outputs: Parameterization_outputs area

In addition to the designations of the LEDs, the parameters for the outputs must also define in which color (red/green/blue) the LEDs should light up:

e.g.

mpp_component		
machine_on	TRANSLINE function unit/machine on	
led	String[4]	LED designation
red	Bool	TRUE/FALSE
green	Bool	TRUE/FALSE
blue	Bool	TRUE/FALSE
machine_off	TRANSLINE function unit/machine off	
led	String[4]	
red	Bool	
green	Bool	
blue	Bool	
…	…	…
…		

Table 21: parameterizationOutputs area

General release for acquisition of the pushbuttons

In the always_enabled area, individual pushbuttons can be enabled via a bit interface, despite the lack of a global release 34eENABLE. These individual releases are checked cyclically.

6.4.4.6 FC_HT8 (FC402)

When creating the START signal, the FC_HT8 reads once the assignment of the keys from the DB_HT8, calculates the new addresses and enters them in the assigned data block.

This FC forwards all key signals to the DB_DEVICE_INTERFACE area, parameterization_inputs area, as long as the RLO 1 is present at the input parameter ENABLE. The LEDs are always read from the DB_DEVICE_INTERFACE, outputs_assigned area, and then displayed.

With the input parameter LAMPTEST = TRUE, all LEDs on the HT8 are activated.

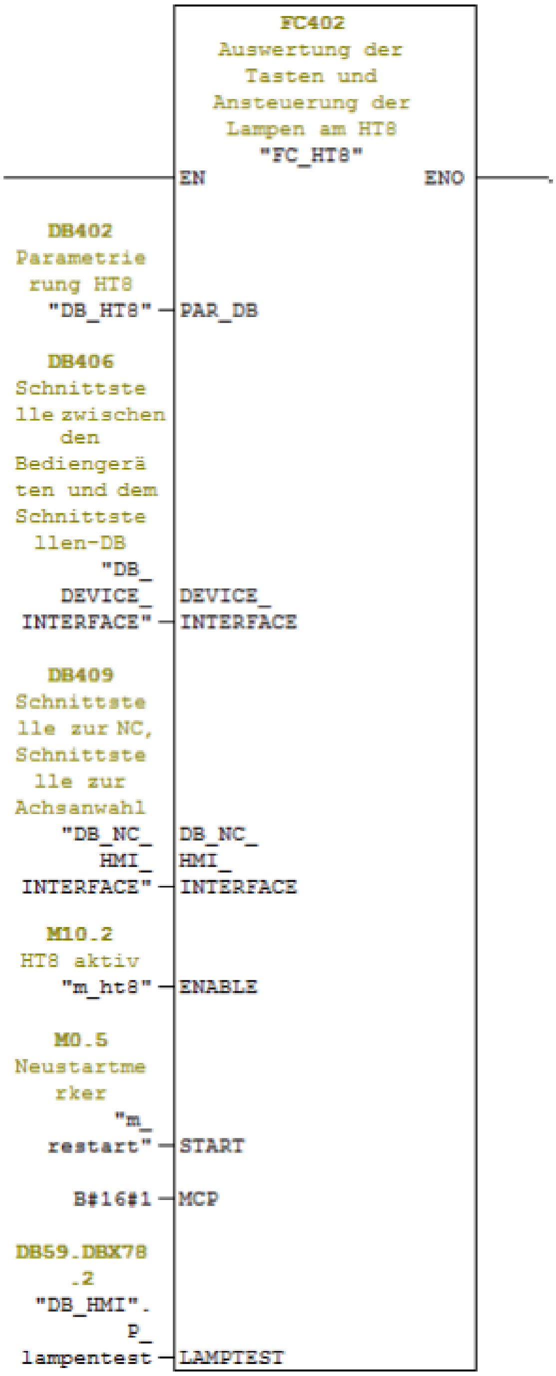


Fig. 55: FC_HT8 (FC402)

Name	Data Type	Comment
PAR_DB	Block_DB	data block for parameterization of the HT8
DEVICE_INTERFACE	Block_DB	data block device interface
DB_NC_HMI_INTERFACE	Block_DB	interface to HMI PRO axis selection screen
ENABLE	Bool	enable of the HT8
START	Bool	first block cycle following CPU newstart
MCP	Byte	HT8 is connected as MCPx, 0=MCP; 1=MCP2; 2=HHU
LAMPTEST	Bool	activates the lamps for test

Fig. 56: FC_HT8 input parameter

Description of input parameters

Parameter	**Data type**	**Description**
PAR_DB	BLOCK_DB	Data block for parameterizing the pushbuttons and function keys on the HT8. This is DB_HT8 (DB402) as the default setting.
DEVICE_INTERFACE	BLOCK_DB	The interface between the operator devices and the blocks for acquiring the operating modes, TRANSLINE functions and NC functions. This is DB_DEVICE_INTERFACE (DB406) as the default setting.
DB_NC_HMI_INTERFACE	BLOCK_DB	Interface between HMI and the PLC. This is DB_NC_HMI_INTERFACE (DB409) as the default setting.
ENABLE	BOOL	Global release for reading in the function and key signals of the HT8.
START	BOOL	First block cycle following a CPU restart. This must be done after every reparameterization of the key interface in DB_HT8 (DB402). The m_restart (M0.5) bit memory in accordance with the TRANSLINE standard is specified here.
MCP	BYTE	B#16#0 The MCP483 is connected as first machine control panel. (addressing: OB100 → FB1, parameters begin with MCP1) B#16#1 The MCP483 is connected as second machine control panel (addressing: OB100 → FB1, parameters begin with MCP2) B#16#2 The MCP483 is connected as HHU parameterized machine control panel (addressing: OB100 → FB1, parameters begin with HHU)
LAMPTEST	BOOL	All outputs (LEDs) are controlled with this signal.

Table 22: Input parameter FC_HT8

Data interface

GP_PAR → DB7

BLOCK_DB

Instance data block of the function block RUN_UP (FB1). These blocks are transferred for an NC version from the NC base program.

Dependencies

The FC_HT8 depends on the base program of the NC and on the interface of the HT8 to the PLC. It requires HMI PRO sl Version >= 04.05.03.09.

DB_HT8 parameterization of the keys of the HT8

The U keys and LEDs are assigned via the data block DB_HT8. U keys are identified with U, LEDs with LU. If the standard key assignment is to be changed, the axis selection screen in the HMI PRO must be customized. The NC keys cannot be changed because there are no slide-in labels.

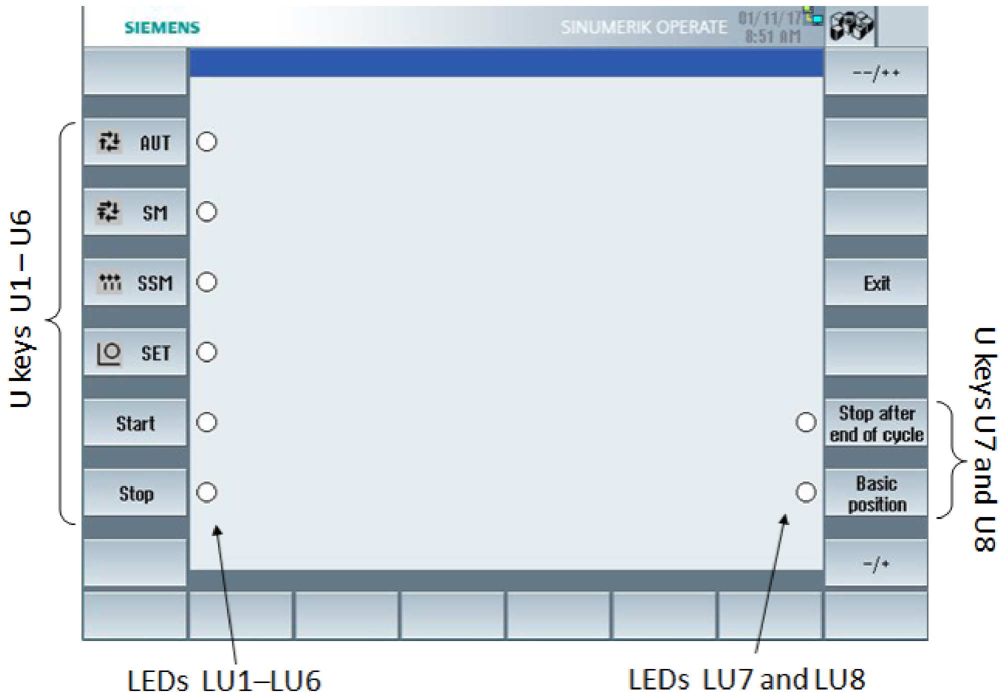


Fig. 57: Possible keys of an HT8

Possible variables

Inputs: Parameterization_inputs area

Outputs: Parameterization_outputs area

mpp_component		
machine_on	String[4]	TRANSLINE function unit/machine on
machine_off	String[4]	TRANSLINE function unit/machine off
media_on	String[4]	TRANSLINE function media on
media_off	String[4]	TRANSLINE function media off
initial_state	String[4]	TRANSLINE function initial state
start_jog	String[4]	TRANSLINE function start/jog single step
acknowledge_fault	String[4]	TRANSLINE function acknowledge fault
fault_will_be_corrected	String[4]	Message to TRANSLINE Collect/VW Master Interface/ PRISMA

all_units_back	String[4]	TRANSLINE function all units back
stop_after_end_of_cycle	String[4]	TRANSLINE function stop after end of cycle
immediate_stop	String[4]	TRANSLINE function immediate stop
lock_rel_protect_doors	String[4]	TRANSLINE function lock/release protective doors
emergency_stop	String[4]	Emergency Stop
automatic_mode	String[4]	TRANSLINE function automatic mode AUT (interlinked)
single_mode	String[4]	TRANSLINE function single mode SM
single_step_mode	String[4]	TRANSLINE function single step mode SSM
setup_mode	String[4]	TRANSLINE function setup mode SET
oem		
fct_1	String[4]	OEM function 1
…	…	…
fct_100	String[4]	OEM function

Table 23: FC_HT8 parameterization_inputs / parameterization_outputs

6.4.4.7 FC_OP_TL_FM (FC405)

The FC_OP_TL_FM processes the key and LED signals of the U key screen. The U key screen is configured as an axis selection screen, which does not contain display and selection options of the axes, but it does contain the U keys for performing the TRANSLINE functions. (For configuration, see Chapter 7 HMI configuration) When creating the START signal, the FC_OP_TL_FM reads the assignment of the keys once from the DB_OP_TL_FM, calculates the new addresses and enters them in the assigned data block.

This FC forwards all key signals to the DB_DEVICE_INTERFACE area, parameterization_inputs section, as long as the RLO 1 is present at the input parameter ENABLE. The LEDs shown in the figure are always read from the DB_DEVICE_INTERFACE, area outputs_assigned, and then displayed.

All LEDs on the operator panel are controlled with input parameter LAMPTEST = TRUE.

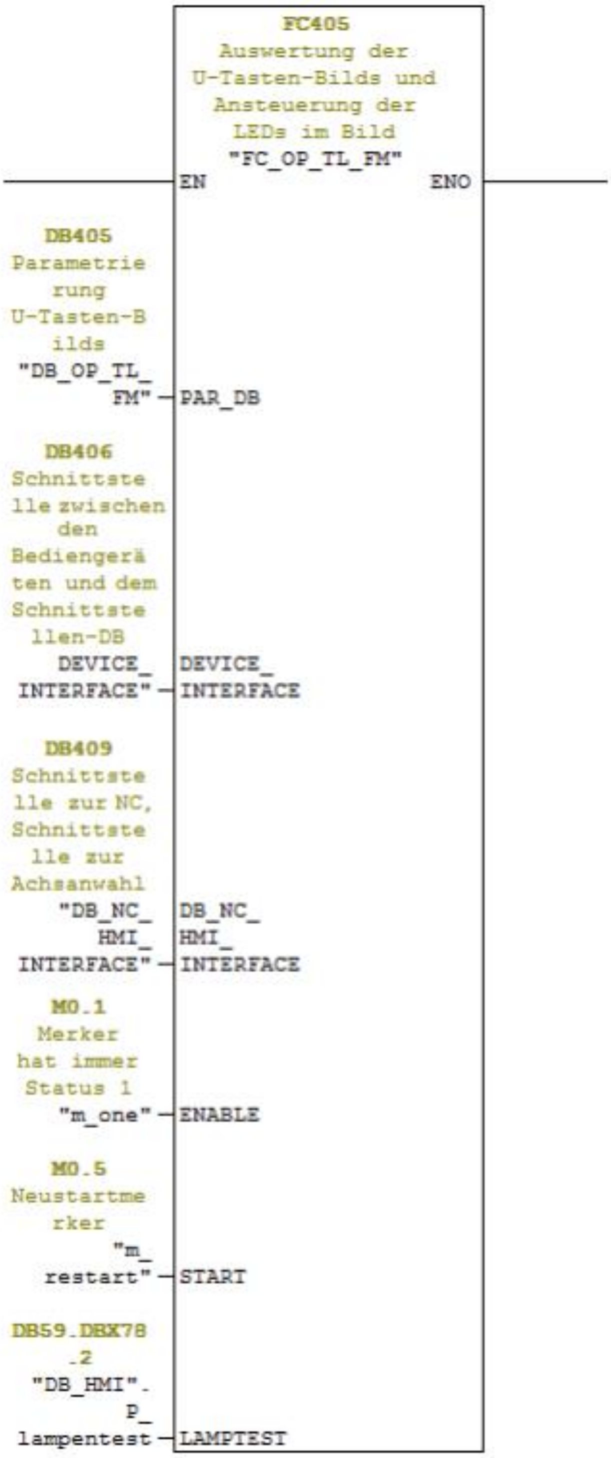


Fig. 58: FC_OP_TL_FM (FC405)

Name	Data Type	Comment
PAR_DB	Block_DB	data block for parameterization of the U key screen
DEVICE_INTERFACE	Block_DB	data block device interface
DB_NC_HMI_INTERFACE	Block_DB	interface to HMI PRO axis selection screen (U key screen)
ENABLE	Bool	enable of the U key screen
START	Bool	first block cycle following CPU newstart
LAMPTEST	Bool	activates the lamps for test

Fig. 59: FC_OP_TL_FM input parameter

Description of input parameters

Parameter	Data type	Description
PAR_DB	BLOCK_DB	Data block for parameterizing the pushbuttons and function keys on the operator panel. This is DB_OP_TL_FM (DB405) as the default setting.
DEVICE_INTERFACE	BLOCK_DB	The interface between the operator devices and the blocks for acquiring the operating modes, TRANSLINE functions and NC functions. This is DB_DEVICE_INTERFACE (DB406) as the default setting.
DB_NC_HMI_INTERFACE	BLOCK_DB	Interface between HMI and the PLC. This is DB_NC_HMI_INTERFACE (DB409) as the default setting.
ENABLE	BOOL	Global release for reading in the function and key signals of the U key menu.
START	BOOL	First block cycle following a CPU restart. This must be done after every reparameterization of the key interface in DB_OP_TL_FM (DB405). The m_restart (M0.5) bit memory in accordance with the TRANSLINE standard is specified here.
LAMPTEST	BOOL	All outputs (LEDs shown in the screen) are activated with this signal.

Table 24: Input parameter FC_OP_TL_FM

Data interface

GP_PAR → DB7

BLOCK_DB

Instance data block of the function block RUN_UP (FB1). These blocks are transferred for an NC version from the NC base program.

Dependencies

The FC_OP_TL_FM depends on the base program of the NC and on the interface of the U key image to the PLC. It requires HMI PRO sl Version >= 04.05.03.09.

DB_OP_TL_FM parameterization of the U keys

The U keys and LEDs are assigned via the data block DB_OP_TL_FM. U keys are identified with U, LEDs with LU. If the key assignment is to be changed from the standard assignment, the screen in HMI PRO (see 7 HMI configuration) must be customized.

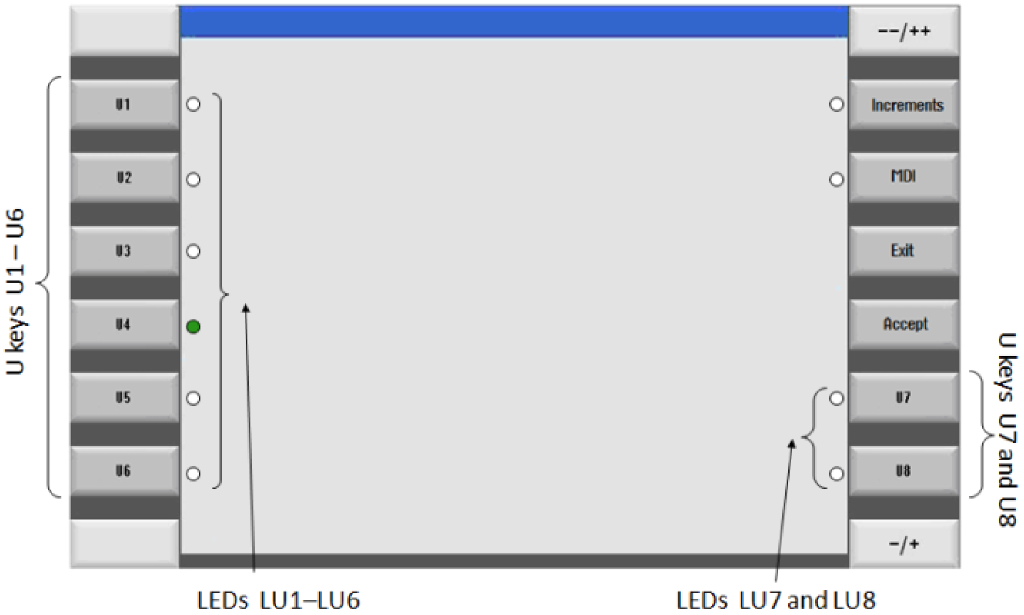


Fig. 60: Possible U keys

Possible variables

Inputs: Parameterization_inputs area

Outputs: Parameterization_outputs area

mpp_component		
machine_on	String[4]	TRANSLINE function unit/machine on
machine_off	String[4]	TRANSLINE function unit/machine off
media_on	String[4]	TRANSLINE function media on
media_off	String[4]	TRANSLINE function media off
initial_state	String[4]	TRANSLINE function initial state
start_jog	String[4]	TRANSLINE function start/jog single step
acknowledge_fault	String[4]	TRANSLINE function acknowledge fault
fault_will_be_corrected	String[4]	Message to TRANSLINE Collect/VW Master Interface/ PRISMA
all_units_back	String[4]	TRANSLINE function all units back
stop_after_end_of_cycle	String[4]	TRANSLINE function stop after end of cycle
immediate_stop	String[4]	TRANSLINE function immediate stop
lock_rel_protect_doors	String[4]	TRANSLINE function lock/release protective doors
emergency_stop	String[4]	Emergency Stop
automatic_mode	String[4]	TRANSLINE function automatic mode AUT (interlinked)
single_mode	String[4]	TRANSLINE function single mode SM
single_step_mode	String[4]	TRANSLINE function single step mode SSM
setup_mode	String[4]	TRANSLINE function setup mode SET
oem		
fct_1	String[4]	OEM function 1
…	…	…
fct_100	String[4]	OEM function

Table 25: FC_OP_TL_FM parameterization_inputs / parameterization_outputs

6.4.4.8 FC_MODE (FC407)

Caution	This block is not safety-related for the purposes of Safety. It does not relieve the OEM of its obligations under the Machinery Directive.

The FC_MODE must be called in the operating mode block FC_OPERATING_MODES (FC61) between the operator panel blocks FC_MPP, FC_MCP, FC_MPP1500, FC_HT8, FC_HT2 or FC_OP_TL_FM and the blocks for the TRANSLINE and NC functions FC_TL_FM or FC_NC_FM.

The FC_MODE performs a specific presetting of the TRANSLINE functions based on the selected Safe operating mode. An attempt is always made to retain the existing function. The block only influences the selection of the TRANSLINE function type. The user must program the feedback (e.g. DB59.dbx76.4 p_setupmode, DB59.dbx86.4 setupmode_rm).

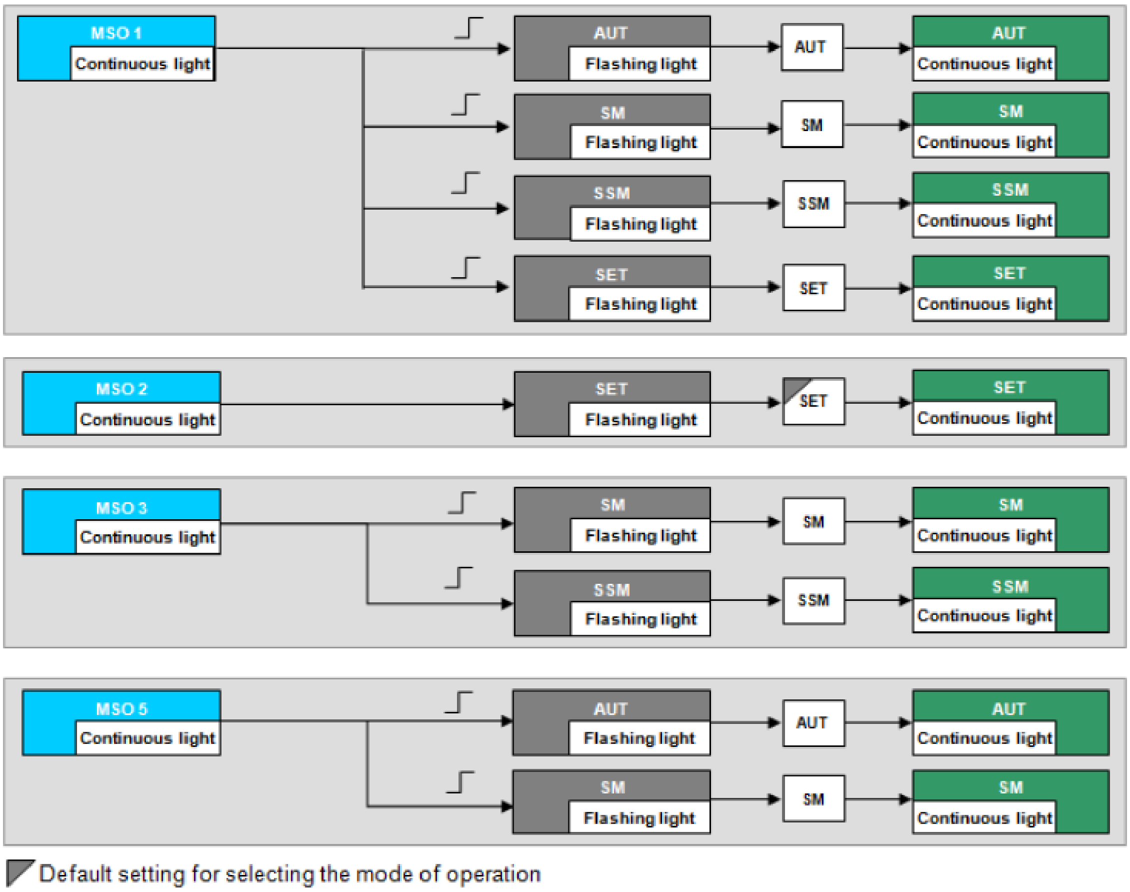


Fig. 61: Diagram of TRANSLINE modes of safe operation

The permitted key functions are defined via the DB_MODE_INTERLOCKS (DB407), taking the safe operating mode and the selected TRANSLINE or NC function into consideration.

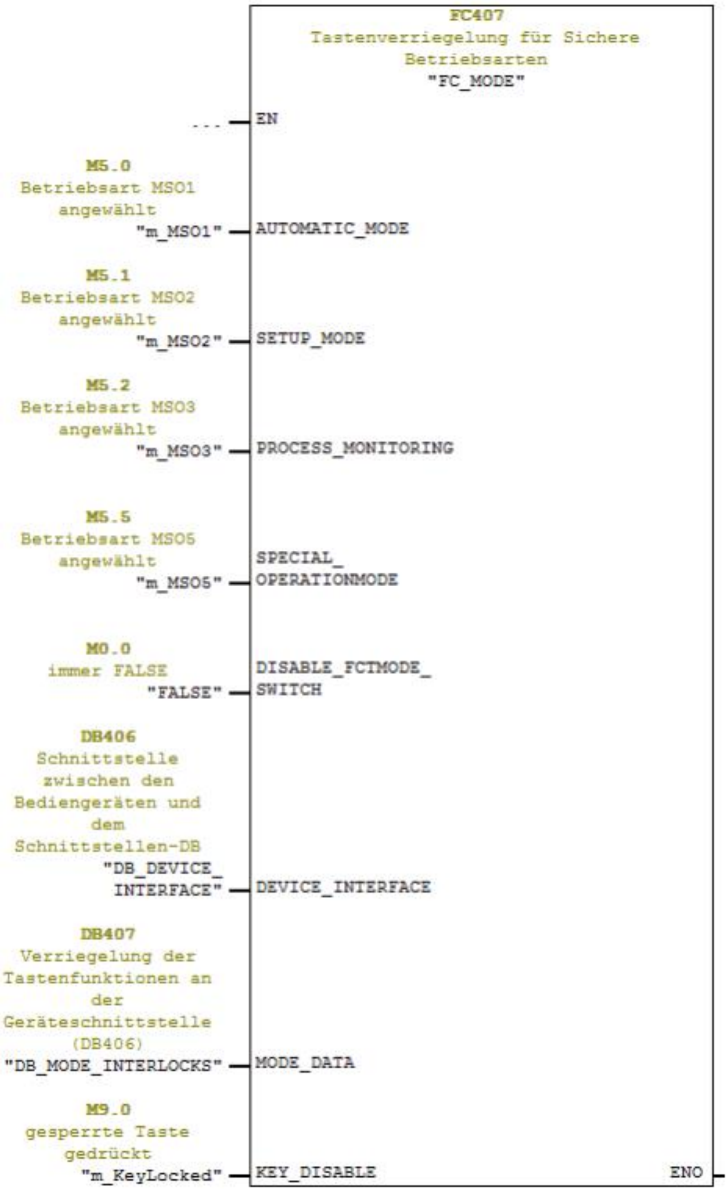


Fig. 62: FC_MODE (FC407)

Name	Data Type	Comment
AUTOMATIC_MODE	Bool	MSO 1 automatic_mode
SETUP_MODE	Bool	MSO 2 setup_mode
PROCESS_MONITORING	Bool	MSO 3 process monitoring mode
SPECIAL_OPERATIONMODE	Bool	MSO SE special operating mode
DISABLE_FCTMODE_SWITCH	Bool	Disable transline function mode switch
DEVICE_INTERFACE	Block_DB	data block device interface
MODE_DATA	Block_DB	data block for mode interlocks

Fig. 63: FC_MODE input parameter

Name	Data Type	Comment
KEY_DISABLE	Bool	RLO=1 -> a locked key is pressed

Fig. 64: FC_MODE InOut parameter

Description of input parameters

Parameter	Data type	Description
AUTOMATIC_MODE	BOOL	TRUE = MSO 1 Production mode, i.e. traversing with closed protection area
SETUP_MODE	BOOL	TRUE = MSO 2 Setup mode, i.e. traversing with open protection area
PROCESS_MONITORI NG	BOOL	TRUE = MSO 3 Process monitoring, i.e. traversing with open protection area
SPECIAL_OPERATIO NMODE	BOOL	TRUE = MSO SE Process monitoring, i.e. traversing with open protection area
DISABLE_FCTMODE_ SWITCH	BOOL	Prevents the automatic selection of the Transline function type of the change of operating mode
DEVICE_INTERFACE	BLOCK_DB	The interface between the operator devices and the blocks for acquiring the operating modes, TRANSLINE functions and NC functions. This is DB_DEVICE_INTERFACE (DB406) as the default setting.
MODE_DATA	BLOCK_DB	Supply of the interlocking interface DB_MODE_INTERLOCKS (DB407)

Table 26: Input parameters FC_MODE

Description of InOut parameter

Parameter	Data type	Description
AUTOMATIC_MODE	BOOL	TRUE = MSO 1 Production mode, i.e. traversing with closed protection area

Table 27: InOut parameters FC_MODE

Data interface DB_MODE_INTERLOCKS (DB407)

The locking of the key functions takes place in this data block on the device interface DB_DEVICE_INTERFACE (DB406); i.e. impermissible keys are suppressed by this block. There are interlocks from

AUTOMATIC_MODE	**// MSO1 or SBA1**
TRANSLINE functions	Linked mode (automatic_mode)
	Single mode (single_mode)
	Single step mode (single_step_mode)
	Setup mode (setup_mode)
SETUP_MODE	**// MSO2 or SBA2**
TRANSLINE function	Setup mode (setup_mode)
PROCESS_MONITORING	**// MSO3 or SBA3**
TRANSLINE functions	Single mode (single_mode)
	Single step mode (single_step_mode)
SPECIAL_OPERATINGMODE	**// MSO SE or SBA4/5**
TRANSLINE functions	Linked mode (automatic_mode)
	Single mode (single_mode)

Table 28: Overview of operating modes

Description for one of the functions, e.g.

Automatic_mode	MSO 1 / Mode of Safe Operation 1	
tl_fct_automatic_mode	Automatic mode	
machine_on	Bool	TRANSLINE function unit/machine on
machine_off	Bool	TRANSLINE function unit/machine off
media_on	Bool	TRANSLINE function media on
media_off	Bool	TRANSLINE function media off
initial_state	Bool	TRANSLINE function initial state
start_jog	Bool	TRANSLINE function start/jog single step
acknowledge_fault	Bool	TRANSLINE function acknowledge fault
fault_will_be_corrected	Bool	Message to TRANSLINE Collect/VW Master Interface/ PRISMA
all_units_back	Bool	TRANSLINE function all units back
stop_after_end_of_cycle	Bool	TRANSLINE function stop after end of cycle
immediate_stop	Bool	TRANSLINE function immediate stop
lock_rel_protect_doors	Bool	TRANSLINE function lock/release protective doors
emergency_stop	Bool	Emergency Stop
automatic_mode	Bool	TRANSLINE function automatic mode AUT (interlinked)
single_mode	Bool	TRANSLINE function single mode SM
single_step_mode	Bool	TRANSLINE function single step mode SSM
setup_mode	Bool	TRANSLINE function setup mode SET
mpp_functions		
auto	Bool	NC function AUTO
mda	Bool	NC function MDA
teach	Bool	NC function TEACH
jog	Bool	NC function JOG
single_block	Bool	NC function SINGLE BLOCK
inc_1	Bool	NC function increment 1

inc_10	Bool	NC function increment 10
inc_100	Bool	NC function increment 100
inc_1000	Bool	NC function increment 1000
inc_10000	Bool	NC function increment 10000
inc_var	Bool	NC function variable increments
goto_refpoint	Bool	NC function goto reference point
repos	Bool	NC function REPOS
nc_stop	Bool	NC function NC STOP
nc_start	Bool	NC function NC start
feed_stop	Bool	NC function feed stop
feed_start	Bool	NC function feed start
spindle_stop	Bool	NC function spindle stop
spindle_start	Bool	NC function spindle start
axis_selection_hmipro	Bool	NC function axis selection screen HMI PRO
mcs_wcs	Bool	NC function switchover request MCS/WCS
reset	Bool	NC function reset
rapid	Bool	NC function rapid traverse
motion_plus	Bool	NC function motion plus direction
motion_minus	Bool	NC function motion minus direction
next_axis	Bool	Key next axis
previous_axis	Bool	Key previous axis
handwheel_active	Bool	Handwheel selected
axes	Array[1..31] of Bool	
axis1	Bool	NC function axis selection
…	…	…
axis31	Bool	NC function axis selection
oem_functions:	Array[1..100] of Bool	
fct_1	Bool	Unassigned function key for OEM
…	…	…
fct_100	Bool	Unassigned function key for OEM

Table 29: Example for Transline function MSO 1

6.4.4.9 FC_TL_FM (FC408)

The FC_TL_FM must be called cyclically after the FC_MODE. The FC_TL_FM reads and writes signals in accordance with the TRANSLINE specifications, as described in the Software Guide, General. It reads the signals from the DB_DEVICE_INTERFACE, inputs.mpp_functions area and enters them in the DB_HMI.

Furthermore, it reads the signals from the DB_HMI and writes them to the DB_DEVICE_INTERFACE area outputs.mpp_functions.

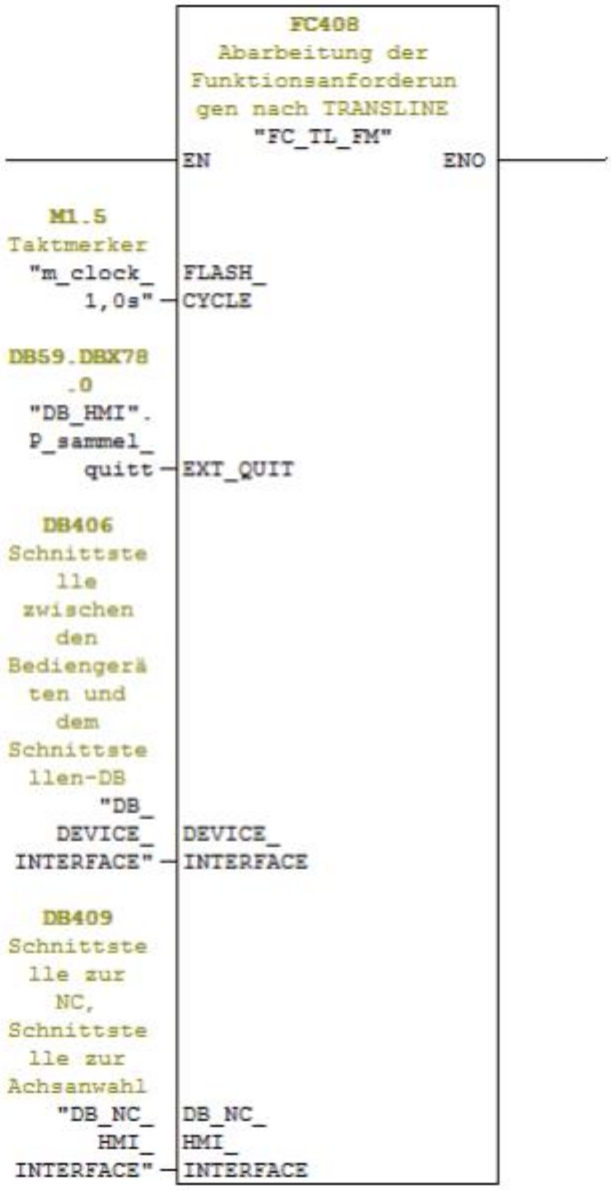


Fig. 65: FC_TL_FM (FC408)

Name	Data Type	Comment
FLASH_CYCLE	Bool	input for flashing flag cycle
EXT_QUIT	Bool	acknowledge external (logical OR with MMP's acknowledge key)
DEVICE_INTERFACE	Block_DB	data block device interface
DB_NC_HMI_INTERFACE	Block_DB	interface to HMI PRO axis selection screen

Fig. 66: FC_TL_FM input parameter (FC408)

Description of input parameters

Parameter	Data type	Description
FLASH_CYCLE	BOOL	Input for flashing bit memory cycle According to the TRANSLINE Standard, the m_clock_1sec. (M1.5) bit memory is specified here
EXT_ACKN	BOOL	External acknowledgment The external acknowledgment is ORed with the Acknowledge key of the MPP when acknowledging via MPP. **Note:** The user must link the following bits for HMI PRO sl under SINUMERIK Operate: O DB_MMC.E_Cancel (DB19.DBX20.2) //OP012 cancel key = m_fault_ackn R DB_MMC.E_Cancel (DB19.DBX20.2) The m_fault_ackn bit memory must be created in the FC_MPP at the parameter EXT_ACKN.
DEVICE_INTERFACE	BLOCK_DB	The interface between the operator devices and the blocks for acquiring the operating modes, TRANSLINE functions and NC functions. This is DB_DEVICE_INTERFACE (DB406) as the default setting.
DB_NC_HMI_INTERFACE	BLOCK_DB	Interface between HMI and the PLC/NC. This is DB_NC_HMI_INTERFACE (DB409) as the default setting.

Table 30: Input parameter FC_TL_FM

Data interface DB_HMI

Interface to HMI PRO. The data block number is taken from the DB19.DBW128:

Dependencies

The FC_TL_FM depends on HMI PRO:

Result of the FC_TL_FM

The signals described below are only controlled by the block if the necessary signals in the DB_DEVICE_INTERFACE are provided by the operator panel FCs;

- **Automatic**
  If automatic_mode is selected in DB_DEVICE_INTERFACE, inputs area, the FC_TL_FM sets the data bit DB_HMI.P_automaticmode (DBX76.1). With the automatic mode active, the user must acknowledge this bit with bit DB_HMI.automaticmode_rm (DBX86.1).
  The bit automatic_mode in the DB_DEVICE_INTERFACE, outputs area, flashes until bit DB_HMI.automaticmode_rm (DBX86.1) assumes status 1; after this, it is continuously activated. When bit

DB_HMI.automaticmode_rm (DBX86.1) is set, symbol in the header is activated.

- **Single mode**
  If single_mode is selected in DB_DEVICE_INTERFACE, inputs area, the FC_TL_FM sets the data bit DB_HMI.P_singlemode (DBX76.2). With single mode active, the user must acknowledge this bit with bit DB_HMI.singlemode_rm (DBX86.2). The bit single_mode in the DB_DEVICE_INTERFACE, outputs area, flashes until the bit DB_HMI.singlemode_rm (DBX86.2) assumes status 1; after this, it is continuously activated. When bit DB_HMI.singlemode_rm (DBX86.2) is set, symbol in the header is activated.

6.4.4.10 FC_NC_FM (FC409)

The FC_NC_FM must be called in cyclical order after the FB_MODE and the FC_TL_FM.

The FC_NC_FM reads the signals from the DB_DEVICE_INTERFACE, inputs.mcp_functions area. Depending on the parameters BAG_EXT, CHANNEL_EXT, AXIS_EXT, these signals are either written to the interface data blocks of the NC (with RLO=0) or to the DB_NC_HMI_INTERFACE (with RLO=1), in the areas bag_data_spec, channel_data_spec, and axis_spec.

If RLO=0 (Parameter ...EXT), the signals are written to the following interface blocks:

Operating modes and machine functions: DB11

Direction keys and overrides: channel DB and axis DB (DB21, 31, 32, ...)

The signals read from the PLC interface of the NC or from the data block DB_NC_HMI_INTERFACE,

bag_data_feedback, channel_data_feedback, and axis_feedback areas, are written to the DB_DEVICE_INTERFACE, outputs.mcp_functions area. Feed start/stop and spindle start/stop are passed to the InOut parameters FEED_HOLD and SPINDLE_HOLD.

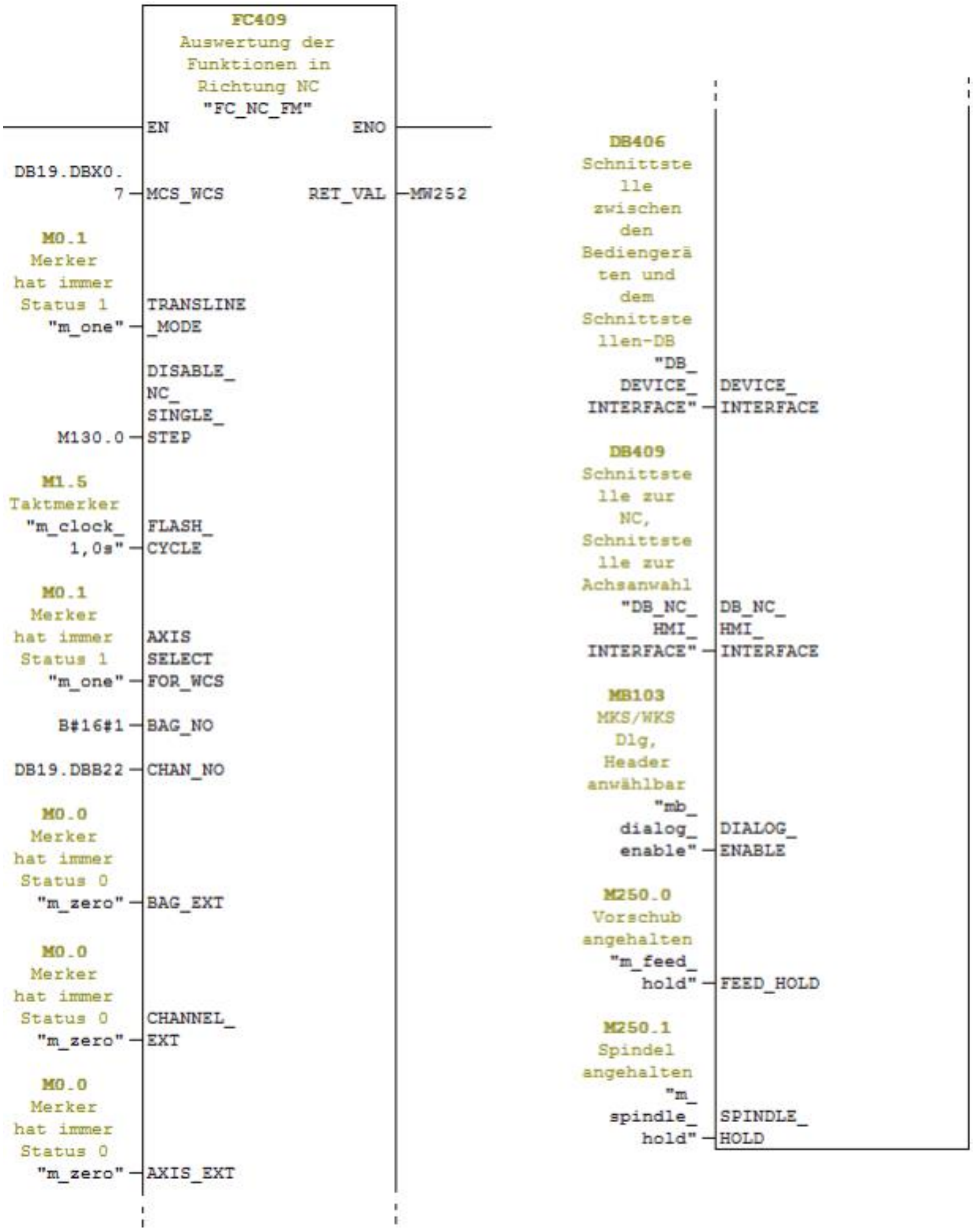


Fig. 67: FC_NC_FM (FC409)

Name	Data Type	Comment
MCS_WCS	Bool	MCS=0, WCS=1
TRANSLINE_MODE	Bool	control of the NC functions depending on the TRANSLINE functions
DISABLE_NC_SINGLE_STEP	Bool	the TL fct. single step mode is not taken over to the NC fct. single step
FLASH_CYCLE	Bool	input for flashing flag cycle
AXIS_SELECT_FOR_WCS	Bool	axis selection in WCS for GEO data with MPP
BAG_NO	Byte	BAG number to which the operating mode signals are transferred
CHAN_NO	Byte	channel number for the channel signals
BAG_EXT	Bool	TRUE -> BAG data is written to DB in DEVICE_INTERFACE
CHANNEL_EXT	Bool	TRUE -> channel data is written to DB in DEVICE_INTERFACE
AXIS_EXT	Bool	TRUE -> axis data is written to DB in DEVICE_INTERFACE
DEVICE_INTERFACE	Block_DB	data block device interface
DB_NC_HMI_INTERFACE	Block_DB	interface to HMI PRO axis selection screen

Fig. 68: FC_NC_FM input parameter

Name	Data Type	Comment
DIALOG_ENABLE	Byte	display MCS/WCS dialog, header display; feedback: axis selection active
FEED_HOLD	Bool	feed hold, latching
SPINDLE_HOLD	Bool	spindle hold, latching

Fig. 69: FC_NC_FM InOut parameter

Description of the input parameters

Parameter	Data type	Description
MCS_WCS	BOOL	TRUE = WCS selected FALSE = MCS selected The specification for the block must correspond to the display in HMI PRO or SINUMERIK Operate.
TRANSLINE_MODE	BOOL	TRUE = Signal is influenced by the TRANSLINE function modes: AUT (linked mode, automatic) = NC automatic mode SM (single mode) = NC automatic mode SSM (single step mode) = optional NC automatic mode single step SET (setup mode) = with switchover to setup - switch is made to NC JOG After this, the other NC functions are enabled. FALSE= MCP functions are always enabled, i.e. the user must establish the relationship.
DISABLE_NC_SINGLE_STEP	BOOL	TRUE = The TRANSLINE function Single step is not imported into the NC function Single step when the mode is switched.
FLASH_CYCLE	BOOL	Input for flashing bit memory clock
AXIS_SELECT_FOR_WCS	BOOL	TRUE = axis selection in the WCS representation is possible at MPP/MCP/HT8 or HT2 (Geo axes only) FALSE = no axis selection in the WCS possible

BAG_NO	BYTE	Number of the mode group to which the mode signals are transferred.
CHAN_NO	BYTE	Channel number for the channel signals. The channel number at the block must agree with the channel displayed on the HMI screen.
BAG_EXT	BOOL	TRUE = The mode group data is not written to the associated area of the mode group data block, but is written to segment 2/3 of the DB_NC_HMI_INTERFACE (DB409).
CHANNEL_EXT	BOOL	TRUE = The channel data is not written to the associated channel data blocks, but is written to segment 4/5 of the DB_NC_HMI_INTERFACE (DB409).
AXIS_EXT	BOOL	TRUE = The axis data is not written to the associated axis data blocks, but is written to segment 6/7 of the DB_NC_HMI_INTERFACE (DB409).
DEVICE_INTERFACE	BLOCK_DB	The interface between the operator panels and the blocks for acquiring the operating modes, the TRANSLINE functions and the NC functions. This is DB_DEVICE_INTERFACE (DB406) as the default setting.
NC_HMI_INTERFACE	BLOCK_DB	Interface between HMI and the NC. This is DB_NC_HMI_INTERFACE (DB409) as the default setting.

Table 31: Input parameter FC_NC_FM

Description of the InOut parameters

Parameter	Data type	Description
DIALOG_ENABLE	BYTE	Bit 0 = TRUE: The MCS dialog in the axis selection screen can be selected by the user Bit 1 = TRUE: The WCS dialog in the axis selection screen can be selected by the user Bit 2 = TRUE: Header display is shown Bit 3 = TRUE: Selection of the axes is blocked (screen can be used for monitoring) Bit 7 = TRUE: Feedback from HMI PRO: Axis selection active
FEED_HOLD	BOOL	TRUE = feed stopped. This signal is not activated from all machine panels. The last status is therefore retained when switching over.
SPINDLE_HOLD	BOOL	TRUE = spindle stopped. This signal is not activated from all machine panels. The last status is therefore retained when switching over.

Table 32: InOut parameters FC_NC_FM

Data interface:

DB11

Interface block for mode group-specific signals; with BAG_EXT = 0

DB21, DB22…

Interface blocks for channel-specific signals; with CHANNEL_EXT = 0

DB31, DB32…

Interface blocks for axis-specific signals; with AXIS_EXT = 0

Dependencies

The FC_NC_FM depends on the base program of the NC and on the interface to the axis selection screen for HMI PRO.

6.4.5 PDA functions

In HMI PRO, the general term PDA functions represent Cycle Time, Workpiece Count, Utilization, Shift Model screens and the Tool Life Overview and Tool Wear screens.

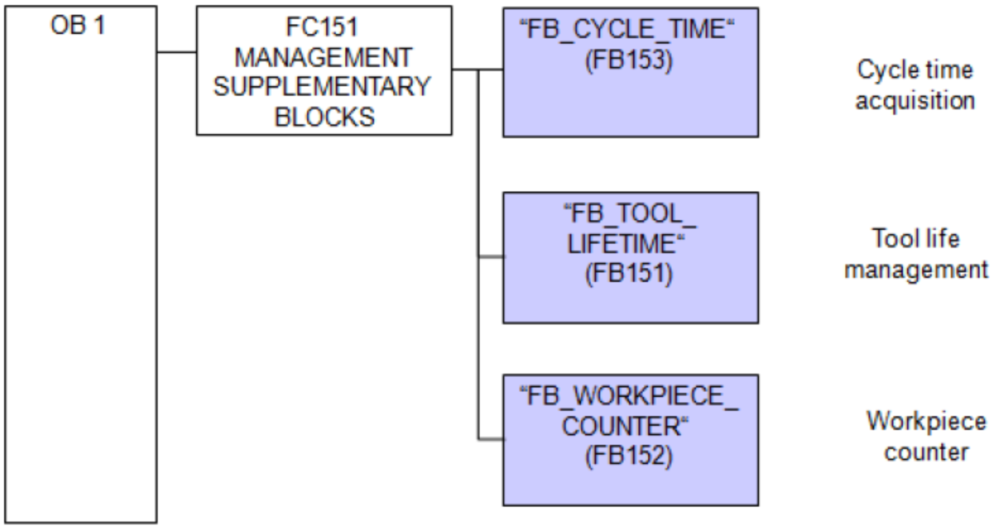


Fig. 70: Call sequence of PDA functions

6.4.5.1 Cycle times

The FB_CYCLE_TIME (FB153) is required for the HMI PRO Cycle times screen (see also online help of HMI PRO CS).

It supplies HMI PRO in the DB_HMI with the measured actual cycle times. It must be called once for the entire machine and once for each displayed machining unit. A machine can have a maximum of 40 machining units (restriction as a result of the DB_HMI).

Cycle times are acquired using SFC64. They are acquired as a multiple of 0.1 second.

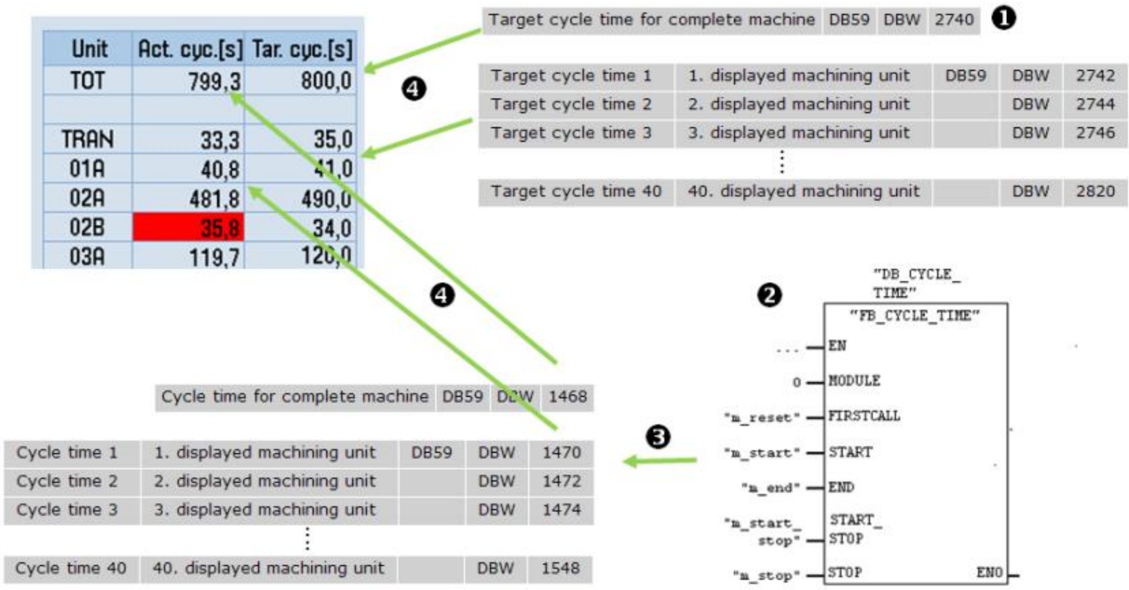


Fig. 71: Relationship between FB_CYCLE_TIME and HMI PRO

Fig. 71 → ❶

The user must enter the target cycle time for the entire machine and the target cycle times for the machining units in the DB_HMI in 1/10 seconds (DB_HMI.targetcycletime_total (DBW2740) DB_HMI.targetcycletime[X] (DBW2742…DBW2820)).

Fig. 71 → ❷

The FB_CYCLE_TIME block must be called once for the entire machine (parameter MODULE = 0) and once for each displayed machining unit (parameter MODULE = X).

Fig. 71 → ❸

Depending on the MODULE parameter, the FB writes the actual cycle times of the entire machine or the actual cycle times of the machining units to DB_HMI (DB_HMI.cycletime_total_mach (DBW1468) or DB_HMI.cycletime[X] (DBW1470… DBW1548).

Fig. 71 → ❹

HMI PRO displays the values from DB_HMI in the Cycle Times screen. If the actual value exceeds the specified setpoint, it is marked red.

FB_CYCLE_TIME (FB153) cycle time

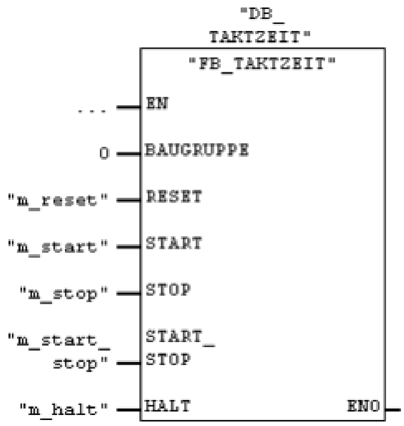


Fig. 72: FB_CYCLE_TIME

Name	Data Type	Comment
MODULE	Int	Module, cycle time sensing
FIRSTCALL	Bool	1st call of block after CPU restart
START	Bool	Start cycle time sensing
END	Bool	End cycle time sensing
START_STOP	Bool	Start&end cycle time sensing
STOP	Bool	Stop cycle time sensing

Fig. 73: FB_CYCLE_TIME input parameter

Application

This block is required for the HMI PRO screen cycle times.

Data interface

The actual cycle times are supplied in the L_H7 and L_H8 data area of the DB_HMI (DB_HMI.DBW1468 to DB_HMI.DBW1548).

Description of input parameters

Parameter	Data type	Description
MODULE	INT	Unit/machine for which the cycle time should be calculated: 1 to 40: Number of the machining unit 0: Complete machine
RESET	BOOL	Initialize block when CPU is restarted. For TRANSLINE: Bit memory m_restart (M0.5)
START	BOOL	The acquisition is started on a positive edge unless an acquisition is already running via START_END. Another positive edge without a previous END causes the cycle time acquisition to restart.
END	BOOL	The acquisition is stopped on a positive edge if the acquisition was started via START. An additional positive edge without a previous START has no effect.

		The START and END parameters belong together. If these two parameters are used, the START_END parameter should be set to 0.
START_END	BOOL	The acquisition is started with a positive edge unless an acquisition is already running via START. The acquisition is stopped on a negative edge. If the START_END parameter is used, the START and END parameters should be set to 0.
STOP	BOOL	The acquisition can be interrupted as many times as required by setting this parameter to TRUE. **Notice** Parameters that are not connected must be set to FALSE. If multiple calls are made, the block must always be supplied the same instance data block.

Table 33: Input parameter FB_CYCLE_TIME

Acquisition of the cycle time with START and END

The acquisition of the cycle times begins with START. The measurement is terminated by END. Measuring takes place only when STOP is not set.

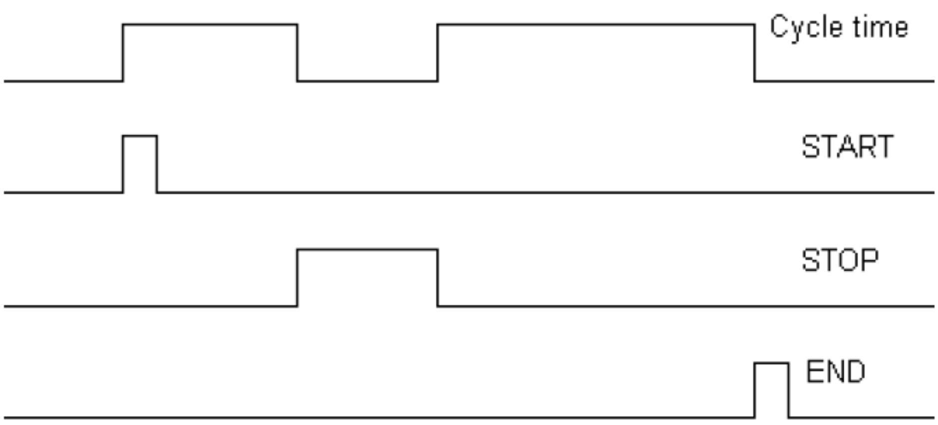


Fig. 74: Cycle time START and END with STOP

Acquisition of the cycle times with START_END

The acquisition of the cycle times is started by the positive edge at START_END. The measurement is terminated by a negative edge at START_END. Measuring takes place only when STOP is not set.

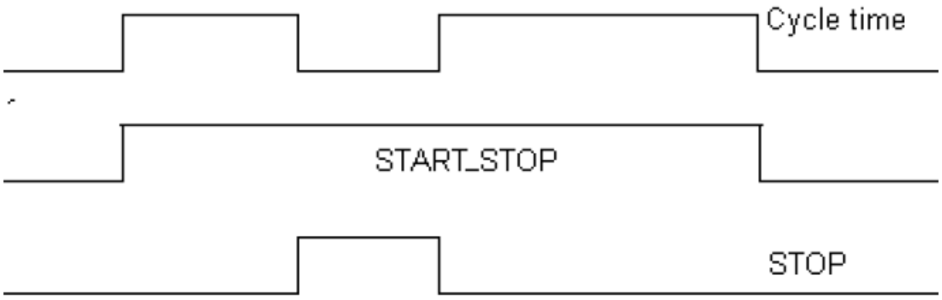


Fig. 75: Cycle time START_END with STOP

6.4.5.2 Type preselection, workpiece overview and part counter

This sequence is used in the workpiece production in the Automatic mode. The workpiece types are defined or displayed when entering using type preselection. The workpiece overview is used to display or influence the machining of workpieces as they pass through the machine. The workpieces are counted at the final station.

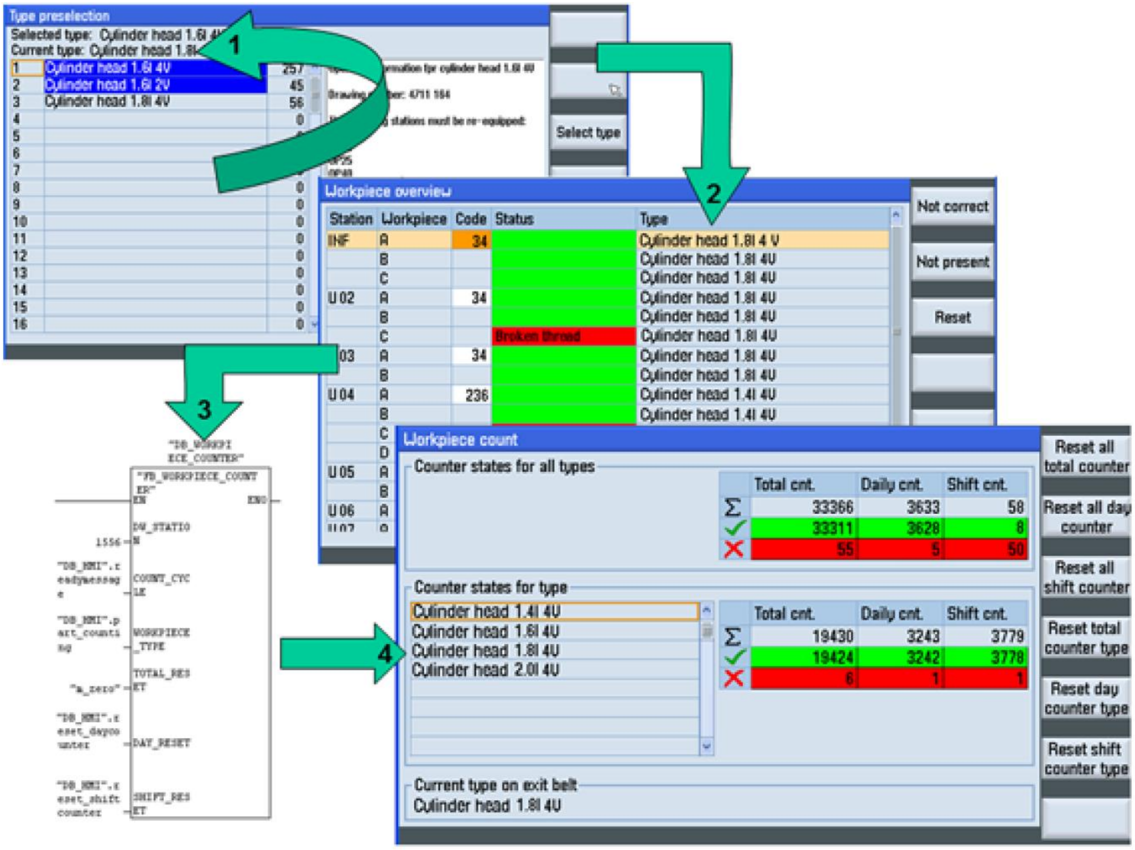


Fig. 76: Relationship between type preselection, workpiece overview and part counter

Type preselection

A standard block is not available for type preselection. The type of workpiece to be machined is identified during type preselection and displayed as the current type on the loading belt. The operator can change the type on the type preselection screen. The type preselected by the operator is transferred using data word

DB_HMI.typ_no (DBW54). The screen ID of the type preselection screen and the plus key are used to trigger application of the type. (Fig. 76 → 1)

```
L       "DB_HMI".screen_No              //(DBW84)
L       58                              //Screen ID type preselection screen
==I
A       "DB_HMI".P_plus                 //(DBX77.1) Plus key on operator panel
JCN type
L       "DB_HMI".typ_no                 //(DBW54) Type number of operator panel
T       "DB_HMI".part_type_preselect    //(DBW1002) Display of "current" type on operator panel
type:   NOP 0
```

During this, you must observe that the type number is BCD-coded in the DB_HMI.typ_no and the low/high byte are switched.

In case of a change concerning types 1-32, the relevant workpiece code is stored in DB_HMI as of partcode[1] (DBW2922); the change of color is stored as of colorchange_part[1] (DBX2986.0).

If over 32 types are available, the structure for this expanded number has to be transferred from DB_HMI. A new data block should be created. This could have the following structure (See Fig. 5-8). The workpiece code can be overwritten by the operator at any time. If this is to be prevented, data words have to be overwritten by the control or the parameters have to be password-protected.

Address	Name	Type	Initial value
0.0		STRUCT	
+0.0	parcode	ARRAY[33..100]	
*2.0		WORD	
+136.0	colorchange_part	ARRAY[33..100]	
*0.1		BOOL	
+146.0	tool_counter	ARRAY[33..100]	
*0.0		STRUCT	
+0.0	part	DWORD	DW#16#0
+4.0	part_fail	WORD	W#16#0
+6.0	day_part	WORD	W#16#0
+8.0	day_part_fail	WORD	W#16#0
+10.0	shift_part	WORD	W#16#0
+12.0	shift_part_fail	WORD	W#16#0
=14.0		END_STRUCT	
=1098.0		END_STRUCT	

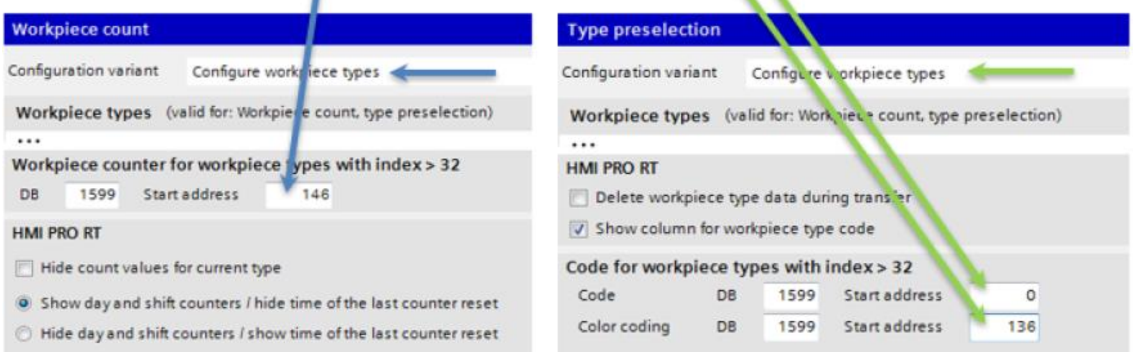


Fig. 77: Format of a separate data block if there are over 32 workpiece types in HMI PRO

If the designations relating to the type is read in via the PLC, a fixed array for the total number of possible type designations must be set up in the PLC. When the trigger bit is set, HMI PRO reads in the entire array (Fig. 77).

Workpiece overview

The Workpiece overview screen shows the workpiece types available for each station, plus the status of the workpieces (OK/not OK). Each workpiece is visualized using the following displays:

- Workpiece code (can be optionally hidden)
- Workpiece type
- Workpiece OK/not OK
- Workpiece present/not present
- Extended workpiece status (see HMI PRO RT online help)

Note	Regarding the display of workpiece types and codes, please note that LOW and HIGH bytes are swapped for workpiece types, as they are for type preselection. Workpiece types and codes are BCD. If the workpiece type in the stations is machined with the aid of the workpiece code, please note that the workpiece code is stored as an integer value.

Transferring the type from type preselection to station 1

In this example, no workpiece code from the data from a data carrier is used

```
AN      "mip_start_typTransfer"          //Transferal of type preselection in station 1
JC      Tr_e
L       "DB_HMI".part_type_preselect     //(DBW1002) Type preselection display
T       "DB_HMI".overview_part_1         //(DBW1556) Type in workpiece overview
CAW                                      //Necessary to exchange Low/High because of BCD
BTI                                      //Convert to integer
T       "DB_HMI".part_type_no1[1]        //(DBW2822) Type stored in workpiece code
                                         //field
SET
=       "DB_HMI".part_A_present_1        //(DBX1558.0) Workpiece present
=       "DB_HMI".wp_A_ok_st_1            //(DBX1558.1) Workpiece OK
Tr_e:   NOP 0
```

If the workpiece code from data from a data carrier is used, the type preselection could be transferred as follows:

```
AN      "mip_start_typTransfer"          //Transferal of type preselection in station 1
JC      Tr_e
L       "DB_HMI".part_type_preselect     //(DBW1002) Type preselection display
T       "DB_HMI".overview_part_1         //(DBW1556) Type in workpiece overview
CAW                                      //Necessary to exchange Low/High because of BCD
BTI                                      //Convert to integer
T       #Type                            //Type as an integer

SET
```

```
=       "DB_HMI".part_A_present_1         //(DBX1558.0) Workpiece present
=       "DB_HMI".wp_A_ok_st_1             //(DBX1558.1) Workpiece OK

// Determine workpiece code
L       32                                //The code for the first 32 workpieces is stored in
L       #Type                             //DB_HMI
<=I
JC      exDB

//Type is in the "DB_HMI" area
OPN     "DB_HMI"                          //Open "DB_HMI"
L       1                                 //Type 1 code stored at DBW2992
-I                                        //therefore - 1
SLW     4                                 //All addresses are specified as bit addresses
                                          //>*16 (with a word)
LAR1    P#DBX 2992.0                      //Start address for code
+AR1    //+ offset for type
L       DBW [AR1,P#0.0]                   //Access to code
T       "DB_HMI".part_type_no1[1]         //(DBW2822) Save in
                                          //workpiece overview
JU      eh01
exDB:   NOP   0
// Type is in supplementary data block
OPN     "DB_SUPPLEMENT_TYPE"              //Open supplementary data block
L       #Type                             //Type 33 and above stored in supplementary block
L       33
-I
SLW     4                                 //All addresses are specified as bit addresses
                                          //>*16 (with a word)
LAR1    P#DBX 0.0                         //Start address for code
+AR1                                      //+ offset for type
L       DBW [AR1,P#0.0]                   //Access to code
T       "DB_HMI".part_type_no1[1]         //(DBW2822) Save in
                                          //workpiece overview
eh01:   NOP0
```

From this point, the user can change workpiece OK / workpiece not OK, present/no present or the workpiece code.

Workpiece OK / workpiece not OK and the workpiece code can be changed by the user on the workpiece overview screen. The PLC programmer is informed of workpiece OK / workpiece not OK and the workpiece code via the DB_HMI.function_no. (DBW79). Since this data word is used for transferring from several screens, the evaluation of the data word must always be locked using the screen ID or screen number (see HMI PRO CS online help). The screen ID is used in this example.

Changing from workpiece OK/workpiece not OK and present/not present

The workpiece properties can be changed using the plus key to indicate workpiece OK or present, or the minus key to indicate workpiece not OK or unavailable.

Checking the screen ID

```
L       "DB_HMI".screen_No                //(DBW84) Screen selected from HMI PRO
L 23                                      //Screen identifier workpiece overview
<>I
```

```
JC      n_1

//Check keys

AN      "DB_HMI".P_plus                 // (DBX77.1)
AN      "DB_HMI".P_minus                // (DBX77.2)
JC      cod1

// Check whether change is OK/not OK or present/not present

L       "DB_HMI".function_no_low        //(DBB79) Low value of the function value –
                                        //BCD coded
L       B#16#40                         //Values < 40 mean OK///not OK
                                        //selected
<=I
JC      ion

 //Present/not present has been changed.
//Coded workpiece and station numbers are stored in function_no_high or function_no_low data
// The workpiece number can be calculated from function_no_high (BCD-coded) – 40.
//Likewise, the station number is calculated from function_no_low (BCD-coded) –40. In the
//following, 41 is subtracted because the workpiece and/or station number 1 correspond to the
//output address.

L       "DB_HMI".function_no_high       //(DBB79) High value of the function value –
                                        //BCD coded
BTI                                     //Convert to integer
L       41                              //Identifier for workpiece property change
-I
T       #workshop number                //(tempVar)
L       2                               //The workpiece properties occupy 2 bits →
*I                                      //times 2
T       #Bit number                     //(tempVar)
L       "DB_HMI".function_no_low        //(DBB80) Low value of the function value –
                                        //BCD coded
BTI                                     //Convert to integer
L       41                              //Identifier for the function from the workpiece overview
-I
T       #stationNo                      //(tempVar)
JU      bit
ion: NOP 0

// OK/not OK has been changed
//Coded workpiece and station numbers are stored in function_no_high or function_no_low data
// The workpiece number can be calculated from function_no_high (BCD-coded) – 40.
//The station number is available directly in function_no_low as a BCD value. In the following
//41 or 1 is subtracted because the workpiece and/or station number 1 correspond to the output
address.
//For the OK/not OK bit, the 2nd bit is addressed, which means that for the bit number, a value of one
//is added.
```

```
L       "DB_HMI".function_no_high       //(DBB79) High value of the function value –
                                        //BCD coded
BTI                                     //Convert to integer
L       41                              //Identifier for workpiece property change
-I
T       #workshop number                //(tempVar)
L       2                               //The workpiece properties occupy 2 bits →
*I                                      //times 2
L       1                               //plus 2 due to 2nd bit as OK/not OK Info
+I
T       #Bit number                     //(tempVar)
L       "DB_HMI".function_no_low        //(DBB80) Low value of the function value –
                                        //BCD coded
BTI                                     //Convert to integer
L       1                               //as index 1 == start address
-I
T       #stationNo                      //(tempVar)

bit: NOP 0

//Calculate bit number
//2 words are available for each station. Word 1 is for the workpiece type. Word 2 for the
//properties of the workpiece type. The STEP 7 address calculation uses bits, which is why each
//Station is increased by 8 * 4 bytes == SLW 5

L       #stationNo                      //(tempVar)
SLW     5                               //*24
LAR1    P#1558.0                        //Start address workpiece properties
+AR1                                    //Address station workpiece properties
L       #Bit number
+AR1                                    //Bit address of the workpiece property

//Set/reset bit for OK/not OK or present/not present

A       "DB_HMI".P_plus
S       DBX [AR1,P#0.0]
A       "DB_HMI".P_minus
R       DBX [AR1,P#0.0]

cod1:   NOP 0
```

Changing the workpiece code

The workpiece code is selected by the user via the Insert key. After it has been entered, the value is stored as an integer in DB_HMI.typ_no (DBW68). The station which has been addressed is stored as a BCD in DB_HMI.function_no_low (DBB79). Secure entry, achieved by checking the limits of the entire word for changing the code, is shown below:

```
// Code changed?

L       DB59.DBW79                      //Summary of function_no_low and
```

```
                                    //high for checking limits
CAW                                 //Correct Low / High
BTD /                               /Convert to integer (D word required as >
                                    //999)
T      #tmp_FctNo                   // (tempVar)

//Value for changing code only valid if 6100 < function number < 6140

O(
L      #tmp_FctNo
L      6100
<=I
)
O(
TAC
L      6140
>I
)
JC     n_1
//Write code.
//The station number of the changed code is stored as a BCD in DB_HMI.function_no_low. Off
//address of the changed station code is determined from the station number and the initial value of
//the station code. Two bytes are used for the code of each station.
//The STEP 7 address calculation uses bits, which is why each station is increased by 8 * 2 bytes ==
//SLW 4.

L      "DB_HMI".function_no_low     //(DBB79) BCD coded station number
BTI                                 //Convert to integer
L      1                            //-1 as start address for station 1
-I
SLW    4                            //*16
LAR1   P#2822.0                     //Start address of the station code
+AR1                                //Address of the selected station code
L      "DB_HMI".typ_no_workpiece    // Workpiece code as an integer
T      DBW [AR1,P#0.0]              //Copied to station code
n_1:   NOP 0
```

Workpiece count (Fig. 77, Fig. 78)

The last station's data is documented with the aid of the workpiece count. The last station type is copied to the data word for Workpiece type on discharge belt DB_HMI.part_type_off_conveyor (DBW1004) and displayed in the workpiece count screen. Counters are updated using the FB_WORKPIECE_COUNTER (FB 152) block.

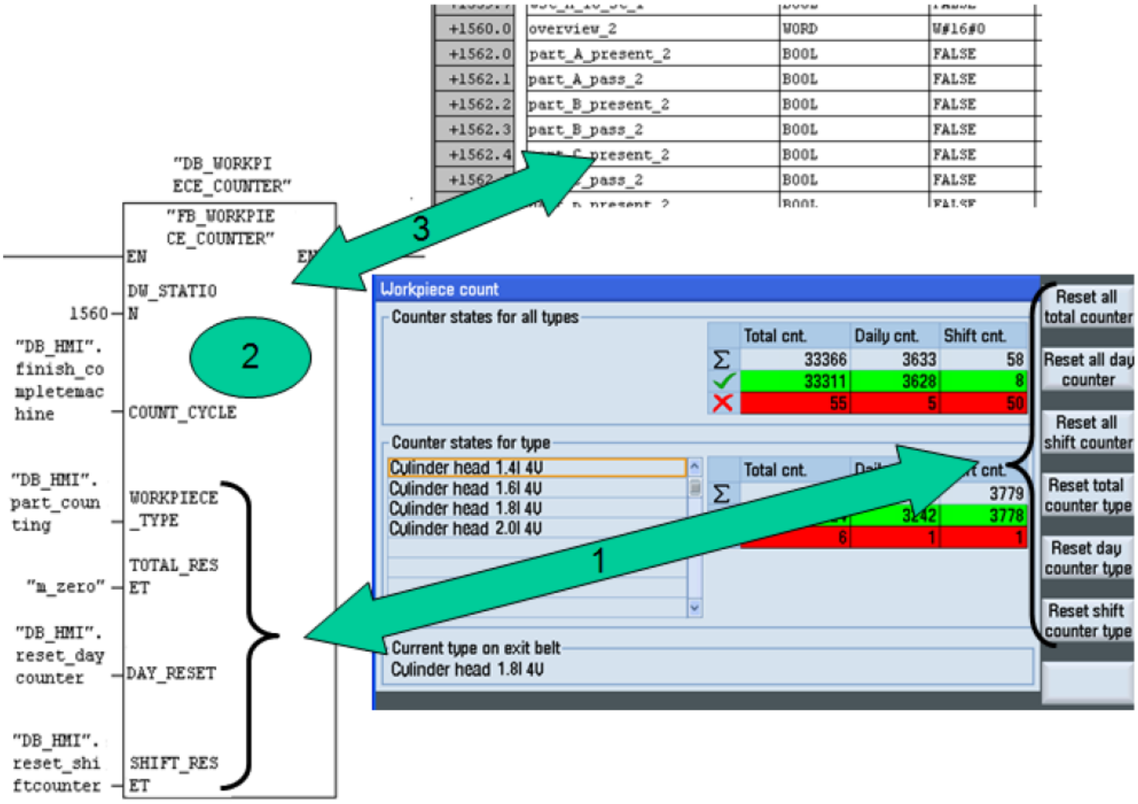


Fig. 78: Relationship between workpiece overview and part counter

The FB_WORKPIECE_COUNTER block receives part of its configuration via DB_HMI. This data is required if more than 32 different workpiece types have been created. They are defined in HMI PRO CS on the Workpiece Count screen under Workpiece counter for types with index > 32 and are written to DB_HMI by HMI PRO RT when the IPC boots.

The user must configure all other parameters by calling up FB_WORKPIECE_COUNTER. The type and property data of the counted workpiece is stored after the start address, which is next to the DW_STATION parameter (Fig. 78 → 2 and Fig. 78 → 3).

With respect to the workpiece type, low/high byte swapping and binary coded decimal are expected. The following 16 bits show by how many pieces per counting cycle and whether it is increased as good part or bad part (see Fig. 78 → 3). The COUNT_CYCLE parameter is used for counting, taking the data described above into account. The WORKPIECE_TYPE, TOTAL_RESET, DAY_RESET and SHIFT_RESET parameters can be used to reset the count data. If, at these parameters, the data from HMI PRO are specified, then the operator can reset the total counter, daily counter and shift counter (Fig. 78 → 1).

HMI PRO writes the following data: (See also HMI PRO CS online help)
DB_HMI.part_type_part_counting (DBW56) → 0 = all types

Note	The counter type to be reset is BCD, and low/high are interchanged.

The total counter is reset using DB_HMI.reset_totalcounter (DBX58.0); the daily counter is reset using

DB_HMI.reset_daycounter (DBX58.1) and the shift counter with DB_HMI.reset_shiftcounter (DBX58.2).

If, in the function key assignment of HMI PRO the Shift model and Utilization screens are integrated, there is an automated version for the counters to be reset. The current shift is stored in the DB_HMI.shift_number (DBB98) data byte. This can be used to determine how shift and daily counters are reset.

```
// Shift change using shift model

L      "DB_HMI".shift_number                  //Shift number (DBB98) is updated by
                                              //HMI PRO
L      "DB_GENERAL_DISPLAY".store_shift
                                              //Buffer storage for change detection
<>I                                           //Each change is one shift change
=      #tmp_shift reset
S      "DB_HMI".reset_shiftcounter            // (DBX58.2)

// Change of day using shift model

L      "DB_HMI".shift_number                  //Shift number (DBB98) is updated by
                                              //HMI PRO
L      "DB_GENERAL_DISPLAY".store_shift
                                              //Buffer storage for change detection
<I                                            //Current shift < previous shift
A(
L      "DB_HMI".shift_number                  //Shift number (DBB98) is updated by
                                              //HMI PRO
L 0
<>I                                           //Shift <> 0
)                                             //Change of day
=      #tmp_dayreset
S      "DB_HMI".reset_daycounter              //(DBX58.1)

L      "DB_HMI".shift_number                  //Shift number (DBB98) is updated by
                                              //HMI PRO
T      "DB_GENERAL_DISPLAY".store_shift
```

FB_WORKPIECE_COUNTER (FB152) unit quantity

This block is required for the Workpiece Count and Workpiece Overview HMI PRO screens. The workpieces machined in the machine are counted using this block. Up to 1000 workpiece types and maximum of 8 workpieces are possible per station. Workpieces are counted each shift, each day and over the entire period. Every counter indicates the sum of all workpieces as well as correct and incorrect workpieces. The counters can be reset.

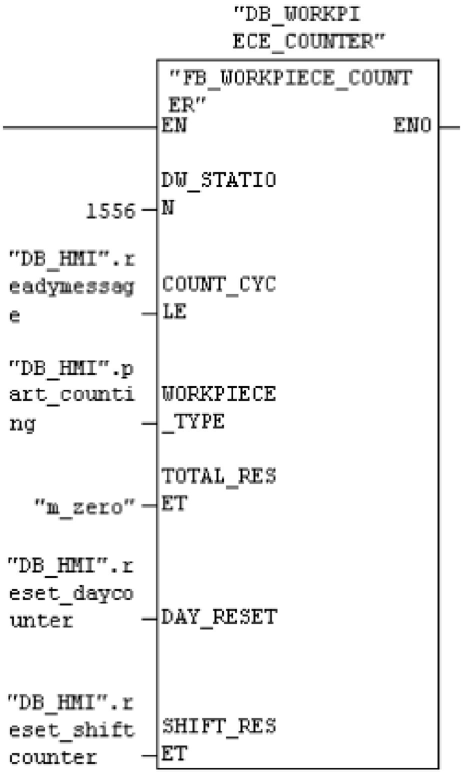


Fig. 79: FB_WORKPIECE_COUNTER

Name	Data Type	Comment
DW_STATION	Int	first DW unload station
COUNT_CYCLE	Bool	Count cycle, production count
WORKPIECE_TYPE	Word	Select workpiece type

Fig. 80: FB_WORKPIECE_COUNTER input parameter

Name	Data Type	Comment
TOTAL_RESET	Bool	Reset total counter
DAY_RESET	Bool	Reset day counter
SHIFT_RESET	Bool	Reset shift counter

Fig. 81: FB_WORKPIECE_COUNTER InOut parameter

Data interface

If the number of types <= 32, data area L_H4_5_6 (DB_HMI.DBW1006 to 1466) is set. If the number of types > 32, the data is transferred from HMI PRO. The number of types is read from DB_HMI.DBW12, the additionally required data block in DB_HMI.DBW8 - and the start address in DB_HMI.DBW10.

The data source is located in the DB_HMI as of DBW1556. Here, a range of up to 40 stations is available, which is to be set accordingly by the user. This range must be specified at parameter DW_STATION (e.g. 1556 for Station1; 1560 for Station2, etc.).

Description of input parameters

Parameter	Data type	Description
DW_STATION	INT	Data word of the unloading station Used to count the type located in the data word.
COUNT_CYCLE	BOOL	Production counter Counting is performed with the positive edge.
WORKPIECE_TYPE	WORD	The workpiece type, preselected by the system supervisor, used for resetting total, daily and shift counters. If this is to be performed via HMI PRO, DB_HMI.part_type_part_counting (DBW56) = 0 (all types) must be set.
TOTAL_RESET	BOOL	Reset total counter If this is to be performed via HMI PRO, DB_HMI.reset_totalcounter (DBX58.0) must be entered. If the counter is reset, the block sets the parameter to 0.
DAY_RESET	BOOL	Reset daily counter If this is to be performed via HMI PRO, DB_HMI.reset_daycounter (DBX58.1) must be entered. If the counter is reset, the block sets the parameter to 0.
SHIFT_RESET	BOOL	Reset shift counter If this is to be realized via HMI PRO, then DB_HMI.reset_shiftcounter (DBX58.2) should be entered. If the counter is reset, the block sets the parameter to 0.

Table 34: Input parameter FB_WORKPIECE_COUNTER

6.4.5.3 Tool lifetime with HMI PRO sl

The tool lifetime is evaluated in HMI PRO sl via the Tool Life Overview and Tool Wear screens.

The following options are available:

- Tool magazine with standard tool management
- Tool group with PLC-based tool management (e.g. in TRANSLINE HMI PRO with DB_HMI or machine manufacturer-specific tool management).

HMI PRO sl and Siemens tool management

In HMI PRO CS, insert the Tool wear screen in the function key assignment of the HMI PRO project.

This screen corresponds to the Tool wear screen of the SINUMERIK tool management and must be configured in the Parameters operating area in the controller.

HMI PRO sl and PLC-based tool management

In HMI PRO CS, insert the Tool life overview screen in the function key assignment of the HMI PRO project:

Configure the tool groups by entering a name for each group. You can also add further information for each tool group in the Tool info field. (see also Help for HMI PRO CS)

The counter values for a maximum of 96 tool groups are managed and stored in the controller. The counter values for the actual value, pre-alarm, alarm and extended alarm are listed in the DB_HMI using the FB_TOOL_LIFETIME_SL (FB151).

Furthermore, the alarm status and the activation of the lifetime extension of a tool group are also displayed.

FB_TOOL_LIFETIME_SL (FB151)

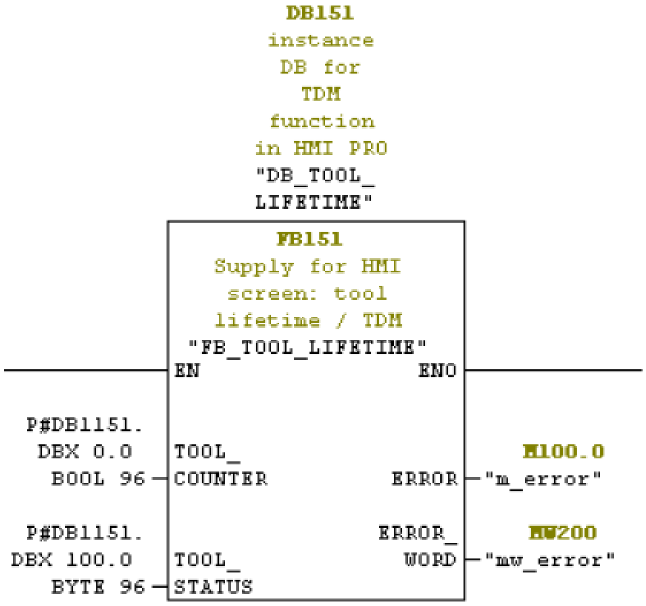


Fig. 82: FB_TOOL_LIFETIME_SL (FB151)

Name	Data Type	Comment
TOOL_COUNTER	Any	BOOL Anypointer. number of varables = number of tools
TOOL_STATUS	Any	BYTE Anypointer. number of varables = number of tools

Fig. 83: FB_TOOL_LIFETIME_SL Input parameter

Name	Data Type	Comment
ERROR	Bool	
ERROR_WORD	Word	

Fig. 84: FB_TOOL_LIFETIME_SL output parameter

Application

This block supplies the tool lifetime screens in the TRANSLINE environment.

Data interface

The block supplies the L_H1_ERW (DB_HMI.extended_ID96_verl (DBW3124) to DB_HMI.tool_group96[96].alarm_limit (DBW4680)) area of the HMI PRO standard data block.

Block description

Up to 99,999,999 machining cycles can be counted per tool group. The block processes as many as 96 tool groups. Each tool group receives its own counting pulse and reports the current status of the tool group to the user program.

Description of input parameters

Parameter	Data type	Description
TOOL_COUNTER	ANY of Type BOOL	The number corresponds to the number of tool groups to be counted. The positive edge of one of the bits increases the number of tool accesses of the corresponding tool group.
TOOL_STATUS	ANY of Type BYTE	The number corresponds to the number of tool groups. This must match the number of the TOOL_COUNTER parameter. Output of messages for the relevant group. Structure of a message byte 0000 0001 → Pre-alarm reached 0000 0010 → Alarm reached 0000 0101 → Alarm extended 0000 0110 → Extended alarm reached 0000 1000 → Tool blocked

Table 35: Input parameter FB_TOOL_LIFETIME_SL

Description of output parameters

Parameter	Data type	Description
ERROR	BOOL	TRUE = Parameterization error
ERROR_WORD	WORD	Status message 01: Error in the TOOL_COUNTER parameter Status message 02: Error in the TOOL_STATUS parameter This can involve the following errors: • Parameter is not of type ANY • No global DB • Number of tool groups > 96 • Number of tool groups not equal to the number configured in HMI PRO • The number of tool groups cannot be divided by 8

Table 36: Output parameter FB_TOOL_LIFETIME_SL

The machine responds to workpiece lifetime alarms in accordance with this table:

Alarm	Immediate stop	Spindle stop	Initial state traversing	Stop after End of cycle	Start inhibit	Warning

Pre-alarm	-	-	-	-	-	X
Alarm	-	-	-	X	X	X
Extended alarm	-	-	-	-	-	X

Table 37: Response to workpiece lifetime alarm

Tool status evaluation

Based on the message byte in the array created at the TOOL_STATUS parameter, the following message can be generated (in the example, MB300 is an element of the status field):

```
// Pre-alarm

O(
A       M 300.0
AN      M 300.1
AN      M 300.2
)
O(                                       //If several groups are used per
                                         //station
A..
)
=       "DB_HMI".prealarm_on_unit1       //(DB59.DBX2700.0) Pre-alarm display in .
                                         // System overview
=       SIN_ALARM_SERVER.AX7000XX[[48]   //(DB2.DBX184.0) Message must be declared
                                         //under HMI PRO CS "Configuration → Alarms"
                                         //

//Alarm or extended alarm achieved

AN      M 300.0                          //Evaluate alarm
A       M 300.1
AN      M 300.2
O(
A       M 300.0                          // Evaluate extended alarm
AN      M 300.1
AN      M 300.2
)
O(                                       //If several groups are used per
                                         //station
A..
)
=       "DB_HMI".wait_time_reached_st1   //(DB59.DBX1716.6) tool life alarm display in .
                                         //plant overview
=       SIN_ALARM_SERVER.AX7000XX[[48]   //(DB2.DBX184.1) Message must be declared
                                         //under HMI PRO CS "Configuration → Alarms".
                                         //
//Header display
```

```
//Tool life alarm
O       "DB_HMI".wait_time_reached_st1      //(DB59.DBX1716.6) Tool life alarm
O       "DB_HMI".wait_time_reached_st2      //(DB59.DBX1717.6) Tool life alarm
O:::
=       "DB_HMI". tool_change_alarm         //(DB59.dbx93.3 Tool life alarm in header

//Tool life pre-alarm
O       "DB_HMI".wait_time_reached_st1      //(DB59.DBX1716.6) Tool life alarm
O       "DB_HMI".wait_time_reached_st2      //(DB59.DBX1717.6) Tool life alarm
O:::
=       "DB_HMI". tool_change_alarm         //(DB59.dbx93.3 Tool life alarm in header

// Activate stop after the end of the cycle because of tool life alarm

O       ..
O       "DB_HMI".wait_time_reached_st1      //(DB59.DBX1716.6) Tool life alarm
AN      "DB_HMI".stop_at_cycleend_reached
A       "m_op_enable_gen"
=       "DB_HMI".stop_at_cycleend_request

//Prevents a start after tool life has been reached

AN      ..
AN      "DB_HMI".tool_change_alarm          //(DB59.dbx93.3 Tool life alarm in header
AN      "DB_HMI".P_stp_after_end_of_cycle
AN      "DB_HMI".moving_to_returned_pos
=       "m_startcondition_auto"
```


6.4.6 Energy data

6.4.6.1 General information

With the energy data recording, the machine manufacturer or the end customer can reduce the energy consumption of their production machines with the aid of control technologies and energy-efficient production means. A first step for such energy management is to record the energy values (e.g. electrical energy, consumption, compressed air, thermal energy) of the individual machines and correlate it with the production data. This allows the key performance indicators (KPI) for the energy consumption to be derived, which can be used as the basis for subsequent actions for reducing the energy consumption and for optimizing the production.

Requirements

The associated blocks are located in the TRANSLINE library. The data is recorded with the SENTRON 7KM PAC4200 measuring device.

System configuration

The SENTRON 7KM PAC4200 measuring device is used for recording the energy. As the expansion module for connection to the SINUMERIK or SIMATIC, module 7KM PAC Switched Ethernet PROFINET is used for the PROFINET connection.

The measuring device SENTRON 7KM PAC4200 can be used for the direct recording of electrical variables. The pulse input of the 7KM PAC4200 can be used for further types of energy.

6.4.6.2 Integrating the SENTRON 7KM PAC4200 into the STEP 7 hardware configuration

The measuring device SENTRON 7KM PAC4200 is used via PROFINET.

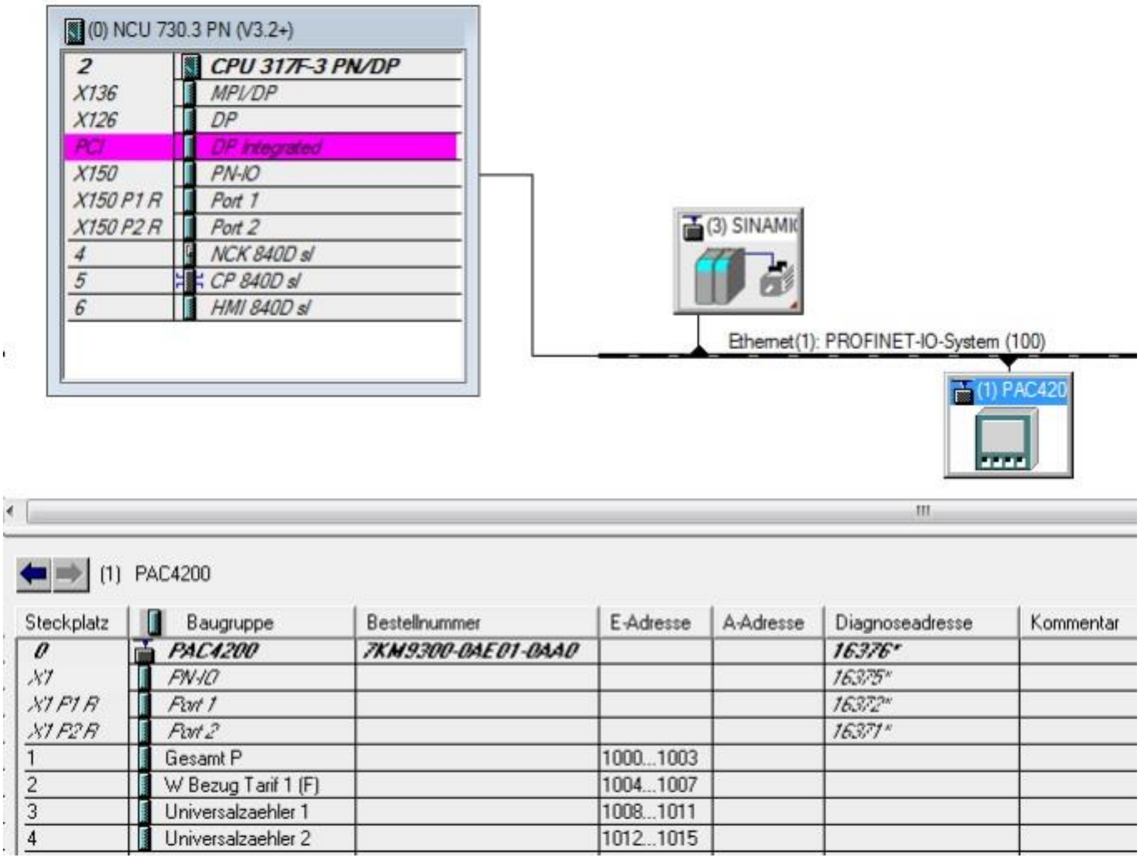


Fig. 85: Integrating the SENTRON 7KM PAC4200 for PROFINET

For the use of the SENTRON 7KM PAC4200 with PROFINET interface, the components Total P (total active power) and W import tariff 1 (F) (active energy import tariff 1 (F)) must be integrated to measure the electrical energy. Two universal counters are available for other energy data.

6.4.6.3 Controller connection

Calling the blocks

The following blocks are available in the TRANSLINE block library for the recording of energy data:

FB_HMI_ENERGY_CONSMPT	FB444	Instance DB DB444 DB_HMI_ENERGY_CONSMPT
FB_ENGY_CONSMPT_MEASM	FB445	Instance DB or as multi-instance in FB_HMI_ENERGY_CONSMPT
FB_HMI_COUNTER	FB446	Instance DB or as multi-instance in FB_HMI_ENERGY_CONSMPT

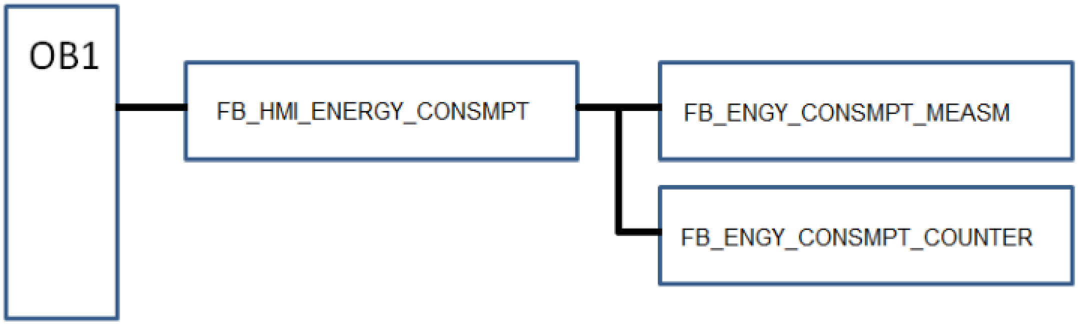


Fig. 86: Call sequence of the energy data blocks

FB_ENGY_CONSMPT_MEASM (FB445) Recording of the electrical energy)

Recording takes place via the FB_ENGY_CONSMPT_MEASM (FB445) in connection with the PAC4200. The following example shows the block as a multi-instance for recording the consumption of electrical energy.

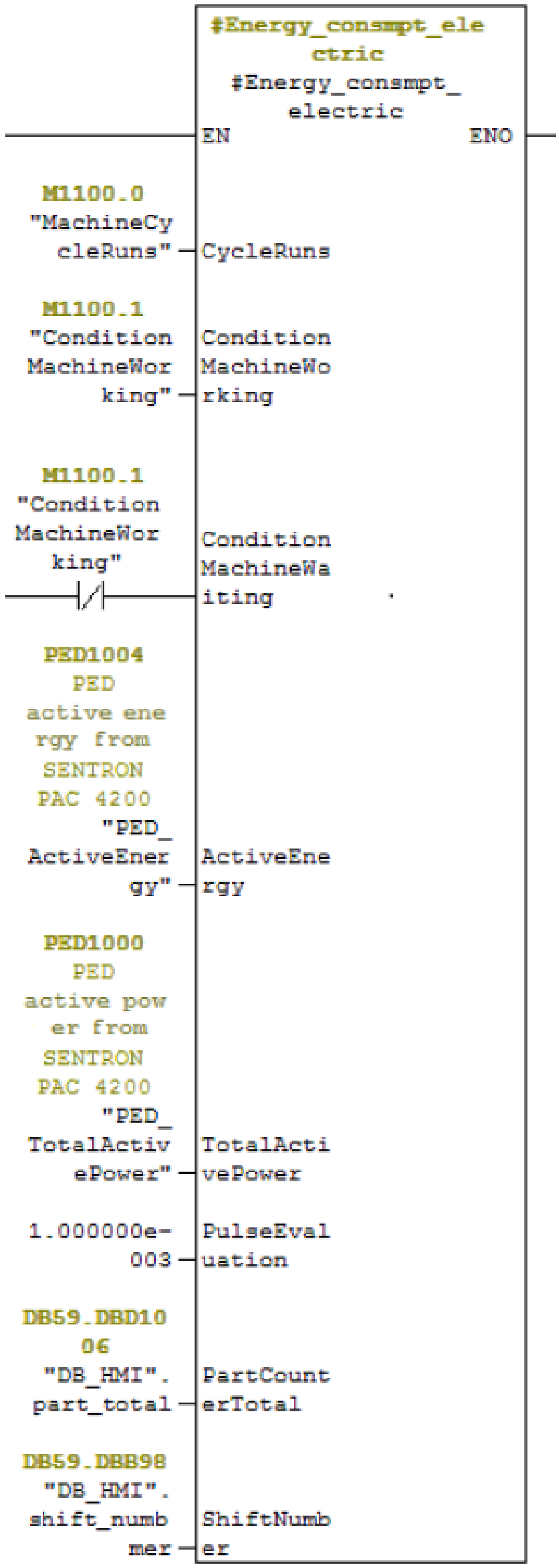


Fig. 87: FB_ENGY_CONSMPT_MEASM (FB445)

Name	Data Type	Comment
CycleRuns	Bool	Energieerfassung pro Takt: Positive Flanke starten, negative Flanke stoppen
ConditionMachineWorking	Bool	Maschine befindet sich im Zustand "In Bearbeitung"
ConditionMachineWaiting	Bool	Maschine befindet sich im Zustand "Warten auf Teil"
ActiveEnergy	Real	Wirkenergie Format:Real Einheit:Wh
TotalActivePower	Real	Wirkleistung Format:Real Einhaeit:W
PulseEvaluation	Real	Impulsbewertung des Zählwertes des Energiezählers Format: REAL
PartCounterTotal	DWord	Gesamtzaehler Werkstücke (Default HMIPRO DB59.DBD1006) Format: DWORD
ShiftNumber	Byte	Schichtnummer der aktuell anstehenden Schicht (Default HMIPRO DB59.DBB98)

Fig. 88: FB_ENGY_CONSMPT_MEASM input parameter

Application

This block is required for the Energy data HMI PRO screen.

Data interface

Only the data parameterized at the inputs is required.

Description of input parameters

Parameter	Data type	Description
CycleRuns	BOOL	Energy measurement per cycle Positive edge: starting Negative edge: stopping
ConditionMachineWorking	BOOL	Machine is in Machining status
ConditionMachineWaiting	BOOL	The machine is in the Waiting for part status, i.e. there is a logical fault, such as No part at infeed signal, Exit occupied signal; No feed parts signal.
ActiveEnergy	REAL	Active power, parameter W import tariff 1 (F) The unit is Wh.
TotalActivePower	REAL	Total active power, parameter Total P The unit is W.
PulseEvaluation	REAL	Pulse evaluation of the count value of the energy meter
PartCounterTotal	DWORD	The respective total workpiece counter of the station must be created here (default: HMI PRO DB59.DBD1006).
ShiftNumber	BYTE	Shift number of the currently pending shift. Three shifts per day are assumed. If the HMI PRO shift model is enabled, it can be used (default: HMI PRO DB59.DBB98).

Table 38: Input parameters FB_ENGY_CONSMPT_MEASM

FB_ENGY_CONSMPT_COUNTER (FB446) Recording of the metered values for other types of energy

Recording takes place via the FB_ENGY_CONSMPT_COUNTER (FB446) in connection with the PAC4200 and the universal counters. The following example shows the block as a multi-instance for recording the energy consumption of the compressed air type of energy.

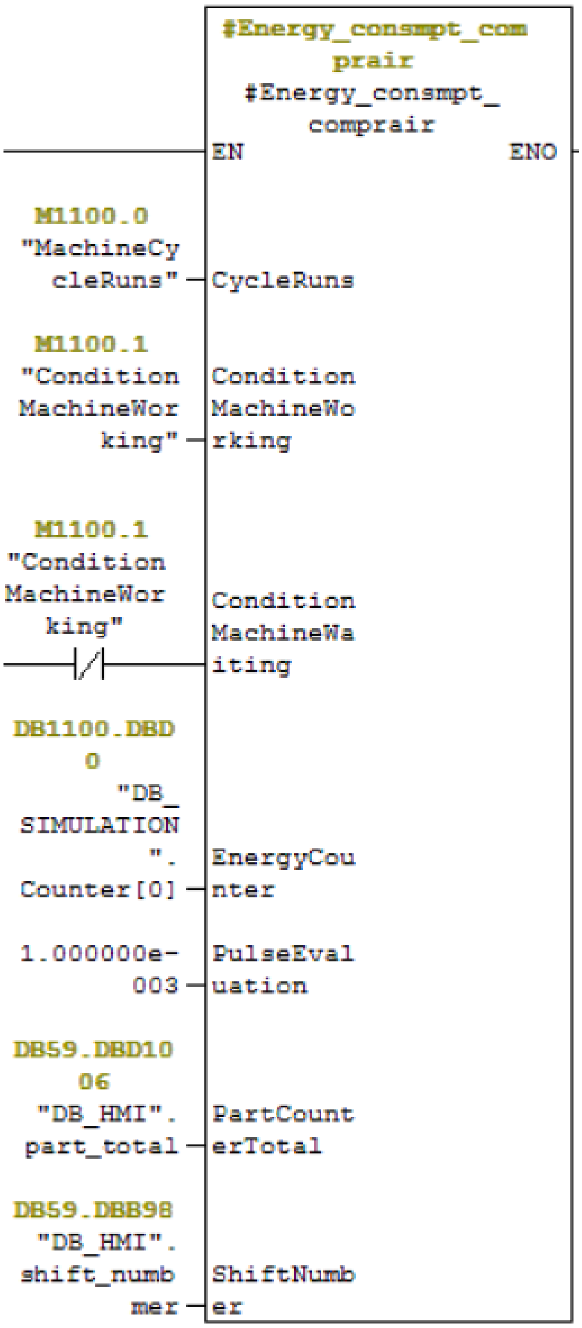


Fig. 89: FB_ENGY_CONSMPT_COUNTER (FB446)

Name	Data Type	Comment
CycleRuns	Bool	Energieerfassung pro Takt: Positive Flanke starten, negative Flanke stoppen
ConditionMachineWorking	Bool	Maschine befindet sich im Zustand "In Bearbeitung"
ConditionMachineWaiting	Bool	Maschine befindet sich im Zustand "Warten auf Teil"
EnergyCounter	DWord	Zählwert eines Zählers für die Energieerfassung (Universalzähler) Format: DWORD
PulseEvaluation	Real	Impulsbewertung des Zählwertes des Energiezählers Format: REAL
PartCounterTotal	DWord	Gesamtzaehler Werkstücke (Default HMIPRO DB59.DBD1006) Format: DWORD
ShiftNumber	Byte	Schichtnummer der aktuell anstehenden Schicht (Default HMIPRO DB59.DBB98)

Fig. 90: FB_ENGY_CONSMPT_COUNTER input parameter

<u>Application</u>

This block is required for the Energy data HMI PRO screen.

Data interface

Only the data parameterized at the inputs is required.

Description of input parameters

Parameter	Data type	Description
CycleRuns	BOOL	Energy measurement per cycle Positive edge: starting Negative edge: stopping
ConditionMachineWorking	BOOL	Machine is in Machining status
ConditionMachineWaiting	BOOL	The machine is in the Waiting for part status, i.e. there is a logical fault, such as No part at infeed signal, Exit occupied signal; No feed parts signal.
EnergyCounter	DWORD	Count value of a counter for the recording of energy (universal counter)
PulseEvaluation	REAL	Pulse evaluation of the count value of the energy meter
PartCounterTotal	DWORD	The respective total workpiece counter of the station is to be created here (HMI_DB.DBD1006)
ShiftNumber	BYTE	Shift number of the currently pending shift Three shifts per day are assumed. If the HMI PRO shift model is enabled, it can be used (HMI_DB.DBB98).

Table 39: Input parameter FB_ENGY_CONSMPT_COUNTER

FB_HMI_ENERGY_CONSMPT (FB444) Compilation of the energy data blocks via an FB

The block is used for compiling the energy data and is created here only as a proposed solution. To reduce the number of data blocks, the instance data blocks of the energy data recording are grouped as a multi-instance in this FB via the FB_HMI_ENERGY_CONSMPT (FB444).

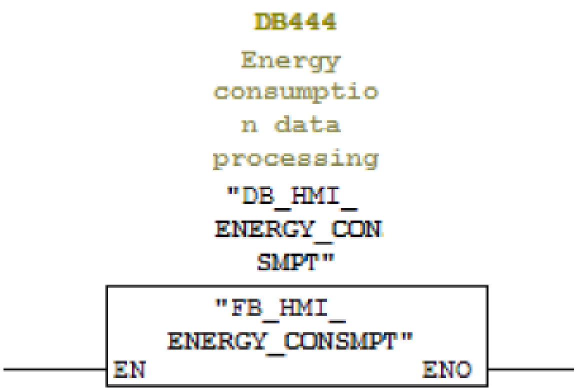


Fig. 91: FB_HMI_ENERGY_CONSMPT (FB444)

Application

This block is required for the Energy data HMI PRO screen.

Data interface

None

Sample structure of the multi-instance

Name	Data Type
Energy_consmpt_electric	FB_ENGY_CONSMPT_MEASM
Energy_consmpt_comprair	FB_ENGY_CONSMPT_COUNTER
Energy_consmpt_coolant	FB_ENGY_CONSMPT_COUNTER

Fig. 92: FB444 - example structure of the multi-instance

6.4.6.4 Energy data in HMI PRO

HMI PRO RT

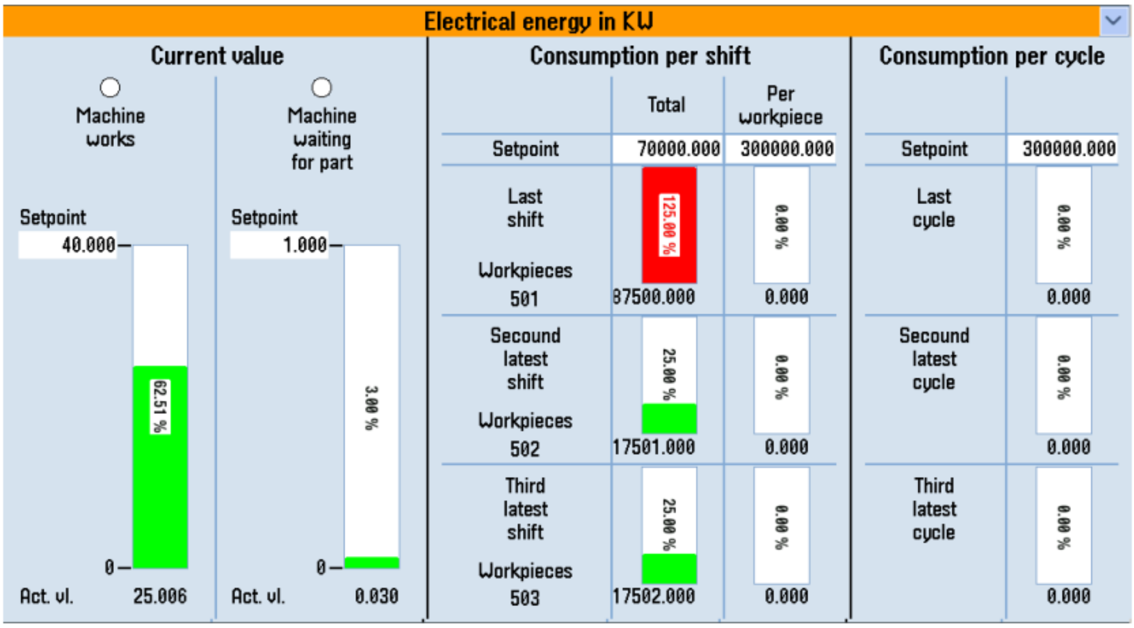


Fig. 93: HMI PRO RT screen: Energy data

The screen shows the energy data of various energy types. You select the type of energy via the drop-down list in the screen header. Depending on the configuration and the current protection level, setpoints can be entered for the consumption in the corresponding fields.

The following energy data is displayed:

- Actual energy values of the machine for the states
  - Machine working
  - Machine waiting for part
- Average energy usage per shift and per workpiece in the shift
- Average energy usage per cycle

The data is output as follows:

- Setpoint: Absolute value with three decimal places
- Actual value: Absolute value with three decimal places

- Percentage actual value: In a column as relative value to the setpoint
- Number of workpieces: Absolute value

Configuration in HMI PRO CS

Add the Energy data screen to the function keys assignment of your HMI PRO project. If the user is to be able to enter setpoints for the consumption, you must parameterize the protection level that is required for this.

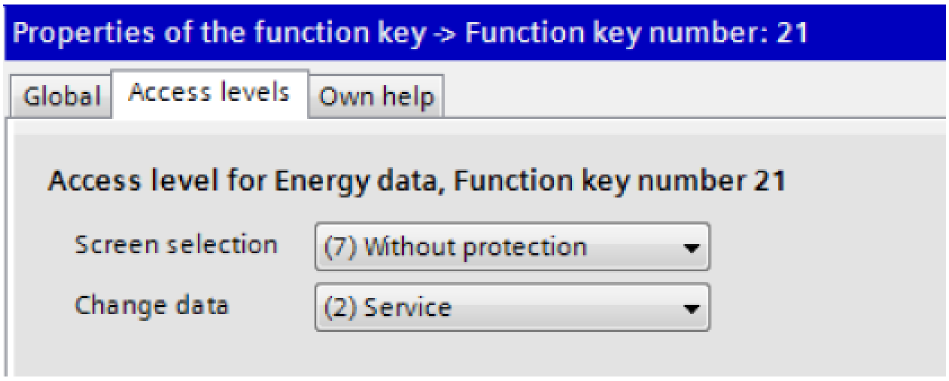


Fig. 94: Parameterization of the protection level in HMI PRO CS

Double-click on the function key in the function key menu to display the configuration interface.

Fig. 95: Configuration of the energy data in HMI PRO CS

Enter the following data in the table from left to right:

- Energy type
- Data block
- Start byte

Refer to the excerpt from the instance DB of energy data recording for the assignment of the data area from the specified start byte.

18.0	stat:in	Energieverb_Elektrisch.ShiftNumber	BYTE	B#16#0	B#16#0	Schichtnummer der aktuell anstehenden Schicht (Default HMIPRO DB59.DBB98)
20.0	stat	Energieverb_Elektrisch.HMI.ShiftValues.WorkpiecesShift_1	DWORD	DW#16#0	DW#16#0	Anzahl Werkstücke der letzten Schicht
24.0	stat	Energieverb_Elektrisch.HMI.ShiftValues.WorkpiecesShift_2	DWORD	DW#16#0	DW#16#0	Anzahl Werkstücke der vorletzten Schicht
28.0	stat	Energieverb_Elektrisch.HMI.ShiftValues.WorkpiecesShift_3	DWORD	DW#16#0	DW#16#0	Anzahl Werkstücke der vorvorletzten Schicht
32.0	stat	Energieverb_Elektrisch.HMI.ShiftValues.TotalEnergySchift_1	REAL	0.000000e+000	0.000000e...	Energieverbrauch der letzten Schicht
36.0	stat	Energieverb_Elektrisch.HMI.ShiftValues.TotalEnergySchift_2	REAL	0.000000e+000	0.000000e...	Energieverbrauch der vorletzten Schicht
40.0	stat	Energieverb_Elektrisch.HMI.ShiftValues.TotalEnergySchift_3	REAL	0.000000e+000	0.000000e...	Energieverbrauch der vorvorletzten Schicht
44.0	stat	Energieverb_Elektrisch.HMI.ShiftValues.EnergyWorkpieceShift_1	REAL	0.000000e+000	0.000000e...	Energieverbrauch pro Werkstück der letzten Schicht
48.0	stat	Energieverb_Elektrisch.HMI.ShiftValues.EnergyWorkpieceShift_2	REAL	0.000000e+000	0.000000e...	Energieverbrauch pro Werkstück der vorletzten Schicht
52.0	stat	Energieverb_Elektrisch.HMI.ShiftValues.EnergyWorkpieceShift_3	REAL	0.000000e+000	0.000000e...	Energieverbrauch pro Werkstück der vorvorletzten Schicht
56.0	stat	Energieverb_Elektrisch.HMI.ShiftValues.SetpointTotalEnergy	REAL	0.000000e+000	0.000000e...	Sollwert (Maximal Wert des Balkens) für Energieverbrauch pro Schicht
60.0	stat	Energieverb_Elektrisch.HMI.ShiftValues.SetpointEnergyWorkpiece	REAL	0.000000e+000	0.000000e...	Sollwert (Maximal Wert des Balkens) für Energieverbrauch pro Werkstück
64.0	stat	Energieverb_Elektrisch.HMI.CycleValues.EnergyCycle_1	REAL	0.000000e+000	0.000000e...	Energieverbrauch des letzten Maschinentakt (Zyklus)
68.0	stat	Energieverb_Elektrisch.HMI.CycleValues.EnergyCycle_2	REAL	0.000000e+000	0.000000e...	Energieverbrauch des vorletzten Maschinentakt (Zyklus)
72.0	stat	Energieverb_Elektrisch.HMI.CycleValues.EnergyCycle_3	REAL	0.000000e+000	0.000000e...	Energieverbrauch des vorvorletzten Maschinentakt (Zyklus)
76.0	stat	Energieverb_Elektrisch.HMI.CycleValues.SetpointEnergyperCycle	REAL	0.000000e+000	0.000000e...	Sollwert (Maximal Wert des Balkens) für Energieverbrauch eines Maschinentaktes
80.0	stat	Energieverb_Elektrisch.HMI.CurrentValues.ValueMachineWorking	REAL	0.000000e+000	0.000000e...	Aktueller Energieverbrauch "Maschine in Bearbeitung"
84.0	stat	Energieverb_Elektrisch.HMI.CurrentValues.ValueMachineWaiting	REAL	0.000000e+000	0.000000e...	Aktueller Energieverbrauch "Maschine wartet auf Teil"
88.0	stat	Energieverb_Elektrisch.HMI.CurrentValues.SetpointMachineWorking	REAL	0.000000e+000	0.000000e...	Sollwert (Maximal Wert des Balkens) für aktueller Energieverbrauch "Bearbeitung
92.0	stat	Energieverb_Elektrisch.HMI.CurrentValues.SetpointMachineWaiting	REAL	0.000000e+000	0.000000e...	Sollwert (Maximal Wert des Balkens) für aktueller Energieverbrauch "Warten"
96.0	stat	Energieverb_Elektrisch.HMI.CurrentValues.ConditionMachineWorking	BOOL	FALSE	FALSE	Maschine befindet sich im Zustand "In Bearbeitung"

Fig. 96: Excerpt from the instance DB of energy data recording

In the example above, from data word 20, you will find the data that is relevant to HMI PRO, i.e. in the configuration in HMI PRO CS, DB444 is entered as the data block and 20 is entered as the start byte.

6.5 EE@Transline

The documentation for EE@Transline is a part of the respective StartupSet, see path: EBOOT/startupset/plc_software/ S7_300.

6.6 S7 GRAPH

6.6.1 Configuration Specifications in the STEP 7 Project

The following settings and specifications are valid for the S7 GRAPH version As of V5.3 + SP6.

6.6.1.1 Alarm-S message procedure

Description of the Alarm-S message procedure

- The message numbers are assigned automatically when you configure in STEP 7. The message texts are assigned uniquely to a diagnostics-capable block (S7 GRAPH block) based on the numbers.
- If a fault occurs, the OP is notified via the message number.
- The associated message text is determined and output based on the number.
- The message text is saved on the OP.
- An ALARM_S is issued by means of SFC17 (with acknowledgment) / SFC18 (without acknowledgment).
- An ALARM_S is triggered by the creation of an interlock or operational sequence error.

Default setting of the message number type in Simatic Manager

This setting must be made once before the first configuration of diagnostic data in the Step7 project!

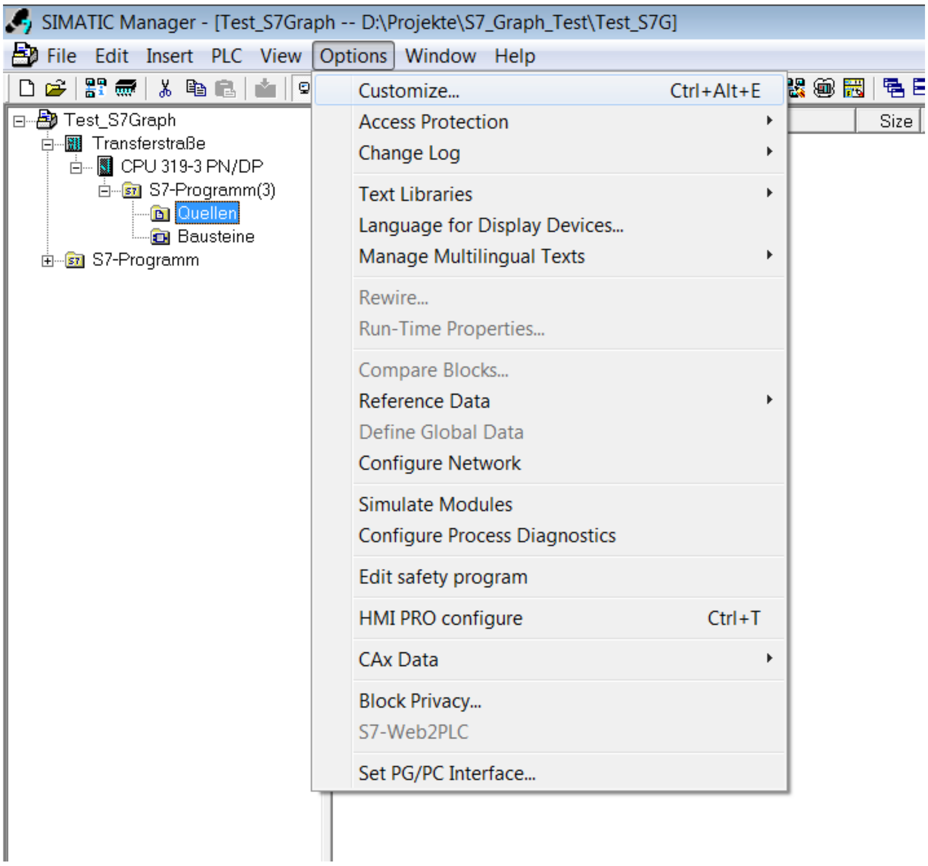


Fig. 97: Selecting the message number setting

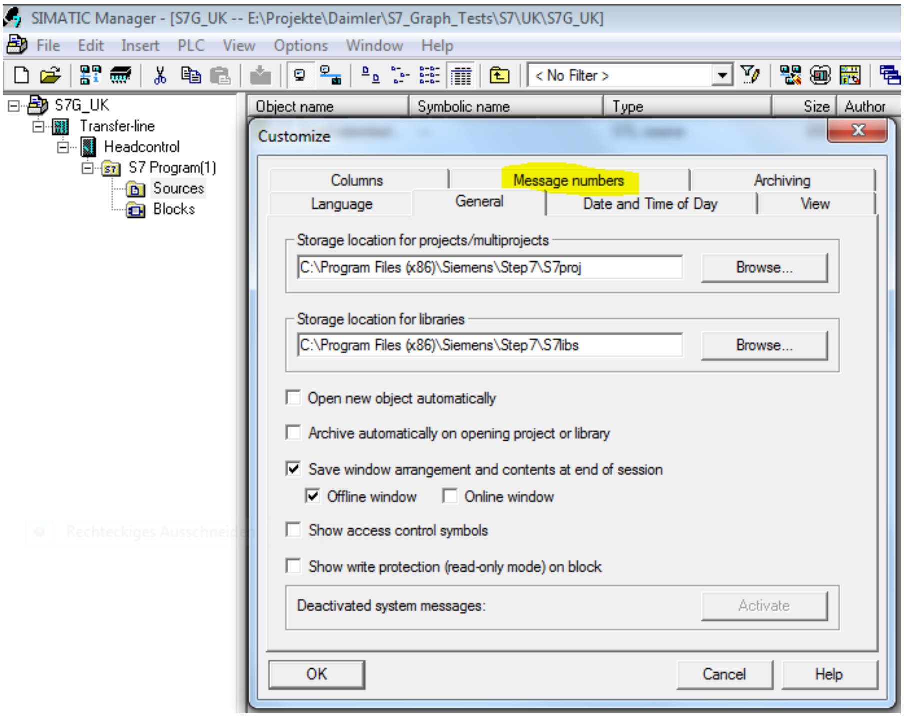


Fig. 98: Selecting the message number setting

Setting for new projects:

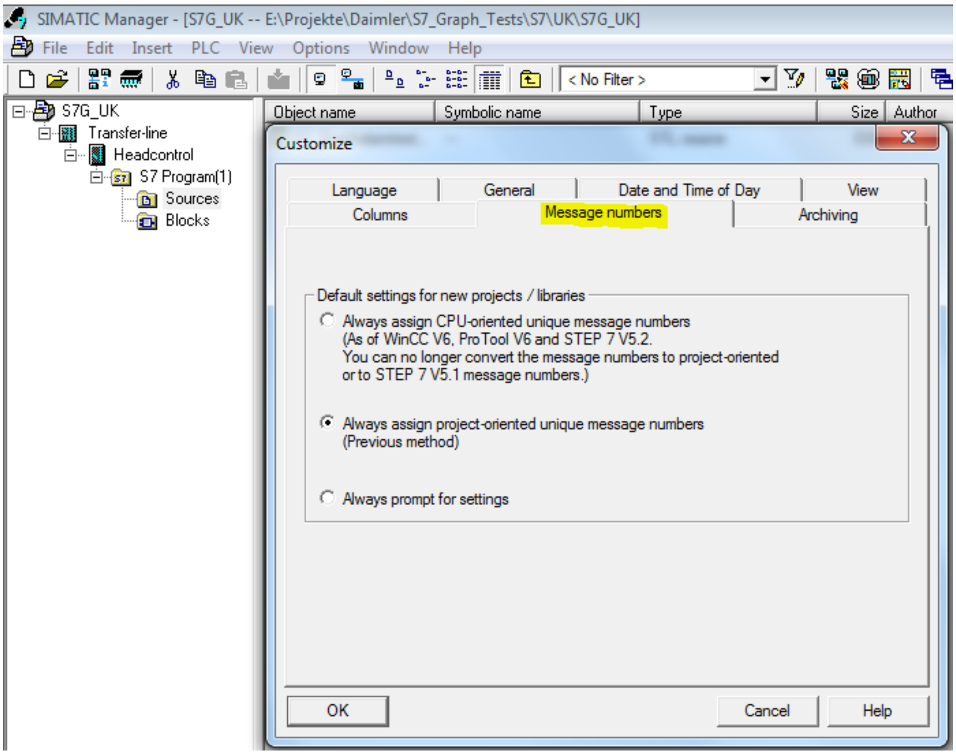


Fig. 99: Message number setting

Assignment of the message number range in Step7

1. Creation of an S7 project
2. Insertion of a station (with HW configuration)
3. Assignment of the message number range
4. Start of the configuration of the user program

Note	Steps 2 and 3 must be repeated for each station in this project.

If operator panels are used, a message number range between 840 000 and 899 999 must be configured.

Ensure that each station for which diagnostic information is to be generated with HMI
PRO process diagnostics, is assigned a network. The networks are assigned in HW configuration. If
no network is assigned to a station within the S7 project, then during the generation with
HMI PRO process diagnostics, the error message "No units that can be diagnosed available" is output.

The message numbers are assigned by selecting the station and then via **Edit > Special object properties >Message numbers**.

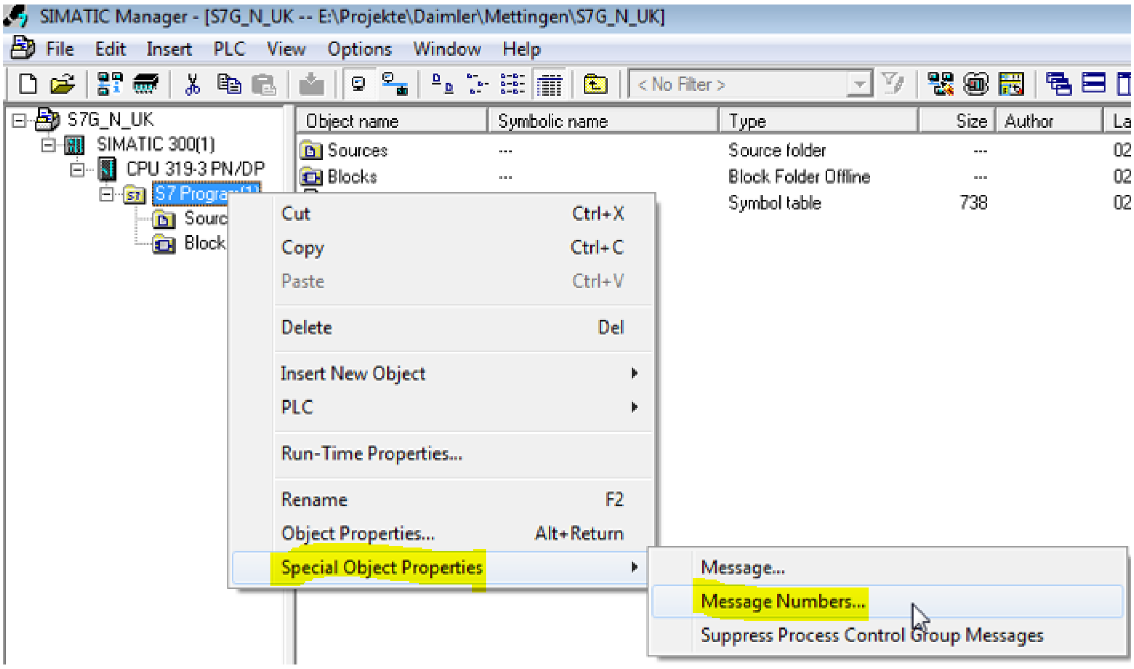


Fig. 100: Setting the message number range

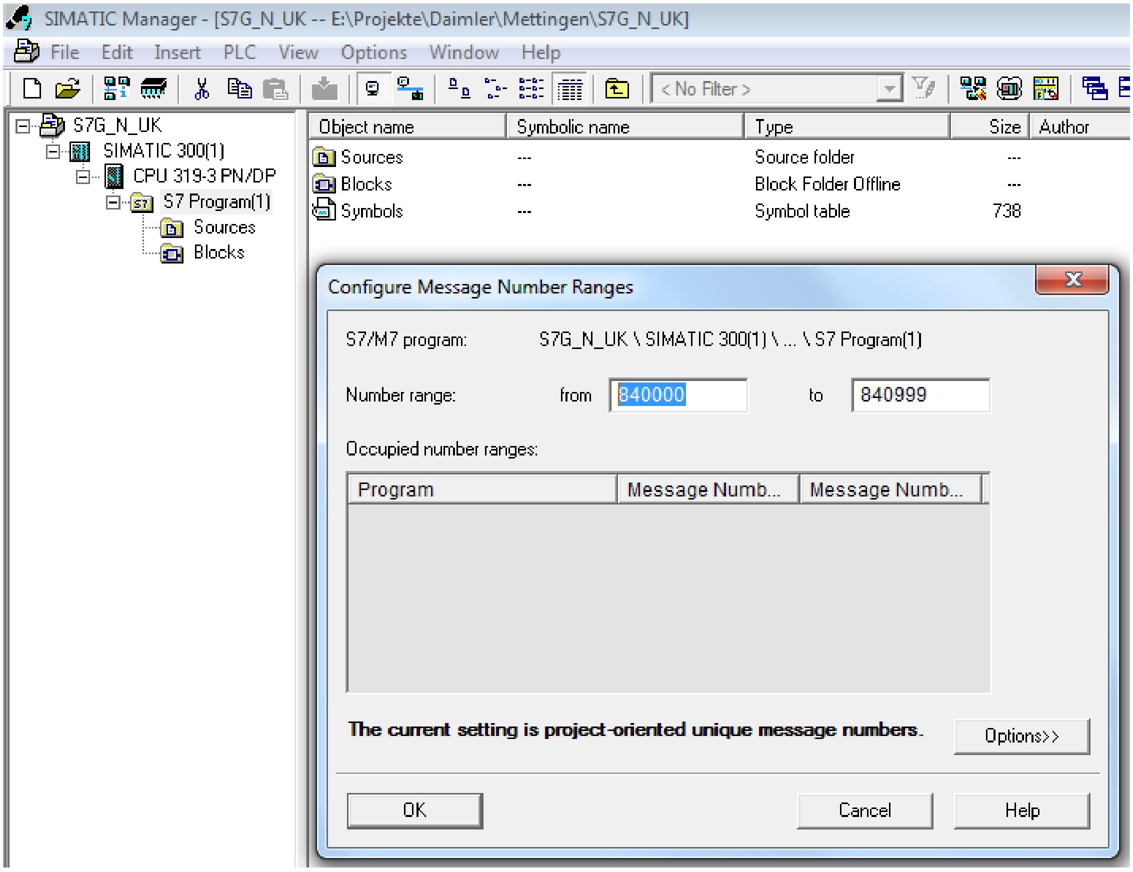


Fig. 101: Setting the message number range on the control

Note	If several controls are configured in an S7 project, different message number ranges must be assigned on the individual controls. Example:

	Station 1	840000-840999
	Station 2	841000-841999
	Station 3	842000-842999
	etc.	

Note	When the ALARM_S signaling system is used, no additional "700000" PLC user error messages are required for the error messages of the S7 GRAPH step sequences.

6.6.1.2 Changing the CPU name

Since the name of the CPU is always displayed in the "Diagnostics Overview" and the "Detail Diagnostics" screens, the station name should be entered here.
Changing the CPU name in the hardware configuration of the STEP 7 project:

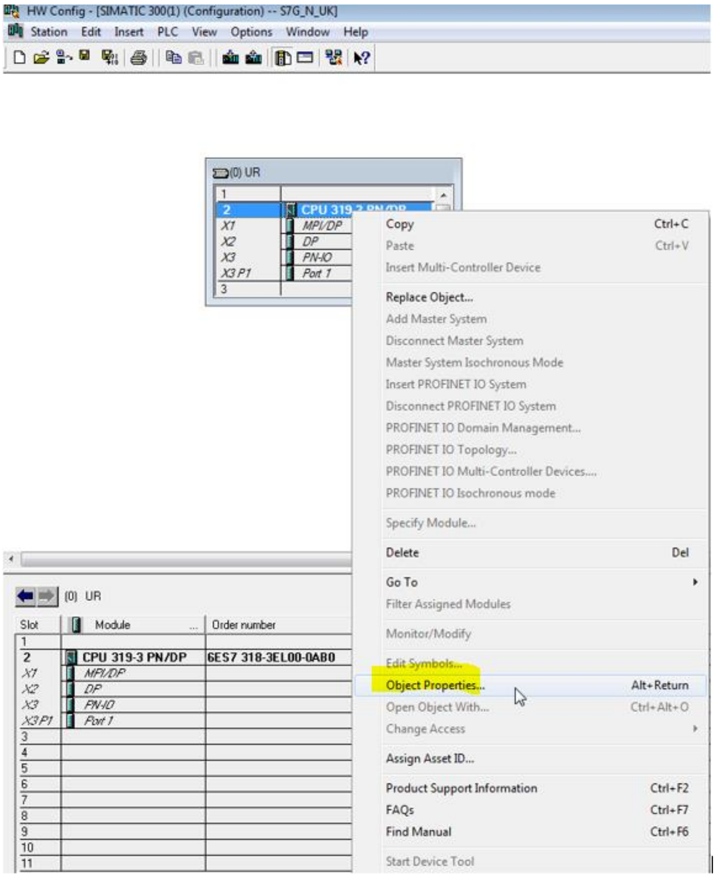


Fig. 102: Selecting the change of the CPU name

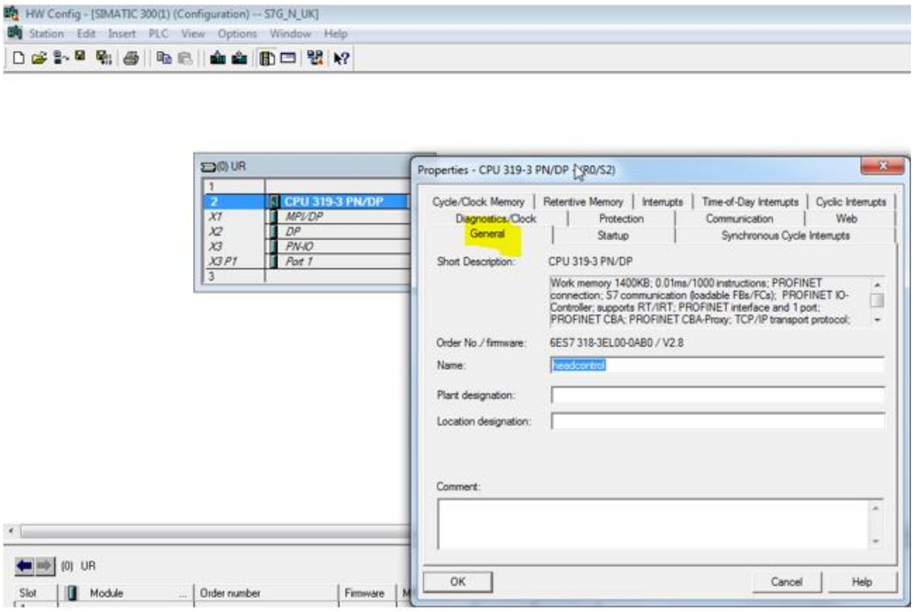


Fig. 103: Selecting the change of the CPU name

Note	The CPU name must be clarified with the technical department of Daimler.

Display in the Diagnostics Overview screen:

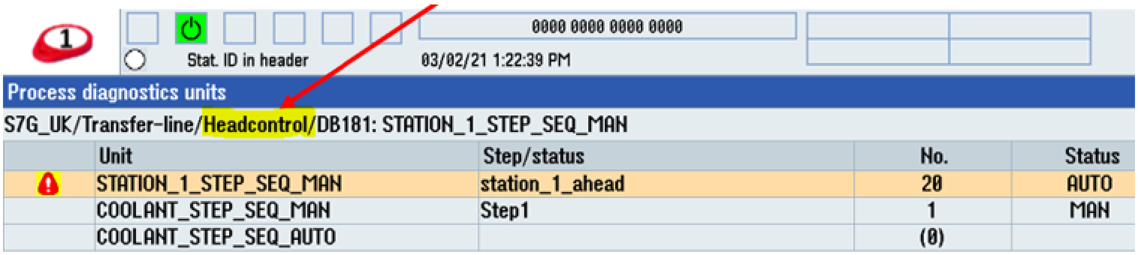


Fig. 104: Example of display of the CPU name in the Diagnostics Overview screen

6.6.1.3 Block structure of the Step7 project

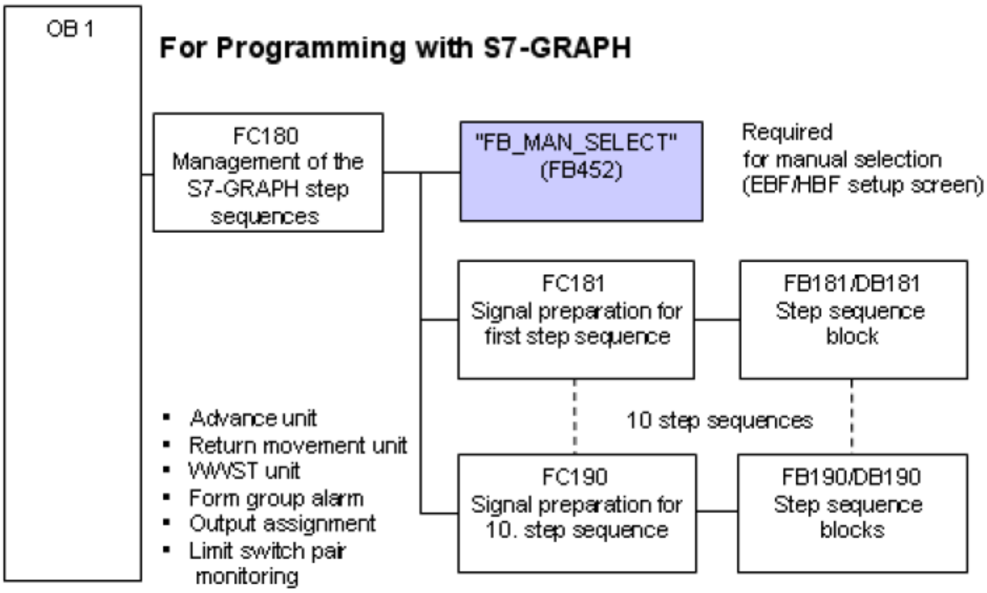


Fig. 105: Block structure of the S7 project

Note	If more than ten step sequences are required, or S7 systems with Distributed Safety are used, the address range of the blocks can be changed to the range as of "1180" and the following.

6.6.1.4 Manual/automatic step sequences

Note	The S7 GRAPH manual and automatic functionalities are implemented separately in their own step sequences and according to the respective technology. With NC systems, the same step number must be used for the same function in the manual and automatic sequences.

Errors in automatic step sequences

Note	If an operational sequence error or an interlock error occurs in an automatic step sequence, the "Automatic" mode must remain active on the step sequence. This is because if the mode is changed to Manual or the step sequence deactivated, an error evaluation no longer takes place.

Configuration of a linear sequencer for manual step sequences

The manual step sequences are programmed as linear sequencers because the step to be activated is selected and deselected manually. In contrast to automatic step sequences, with manual step sequences there is no advance when the transition is fulfilled.

The individual step function is to be listed in the block comment.

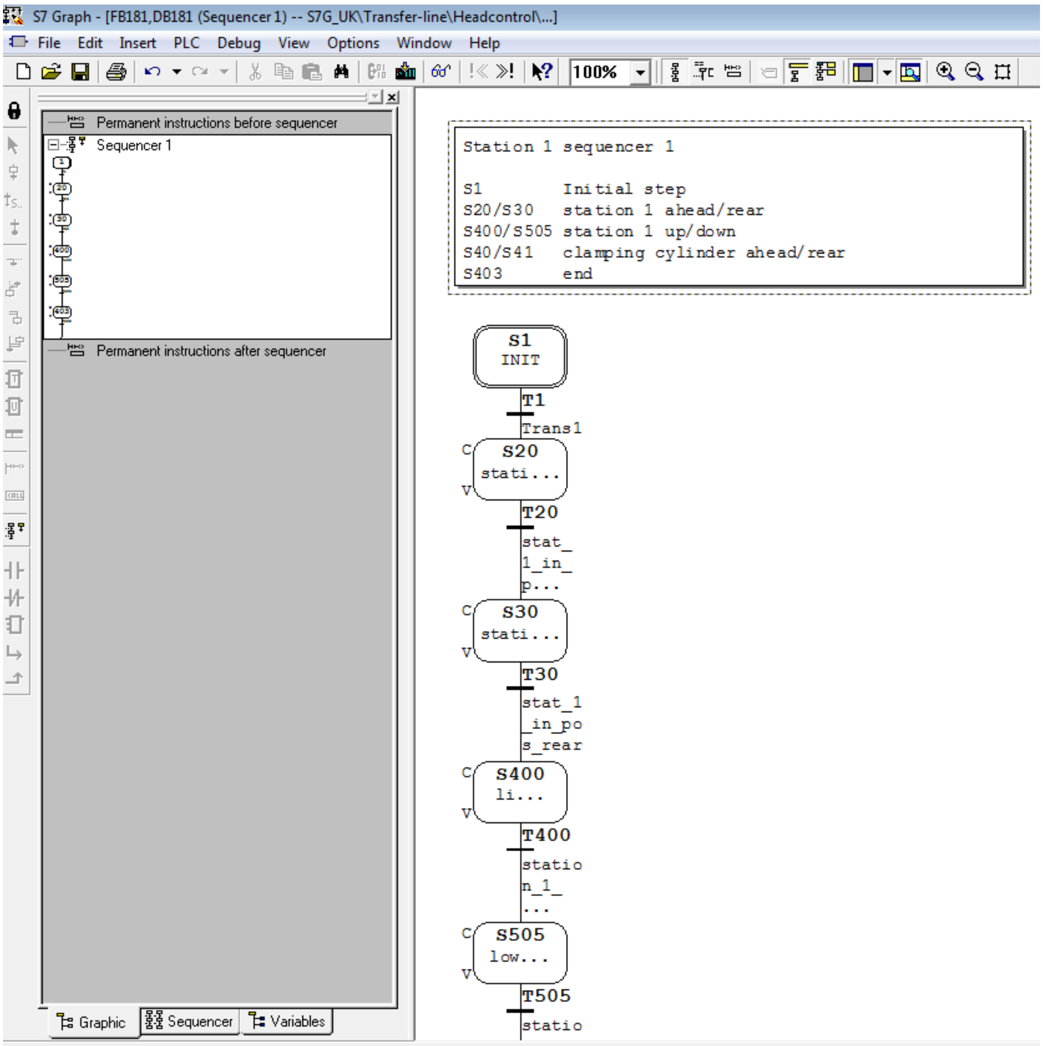


Fig. 106: Linear structure of the manual step sequencer

6.6.1.5 Creating an S7 GRAPH block

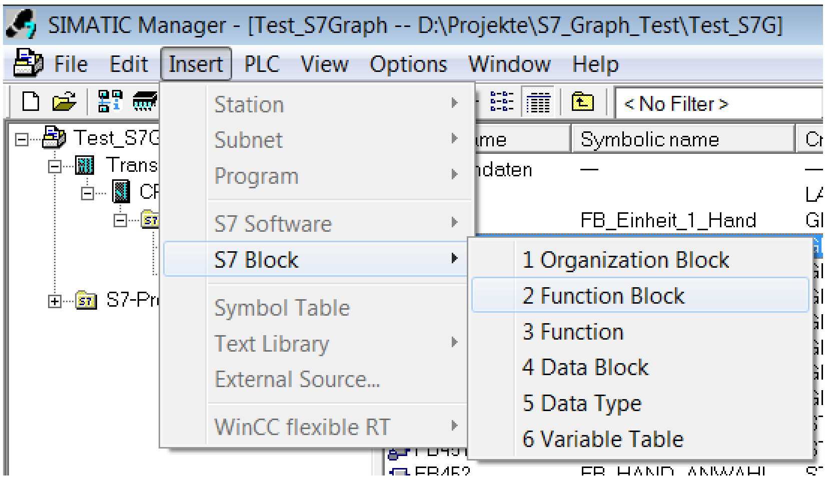


Fig. 107: Creating an S7 GRAPH block

Symbolic name of the step sequence block

The symbolic name of the block should contain information on the function of the block.

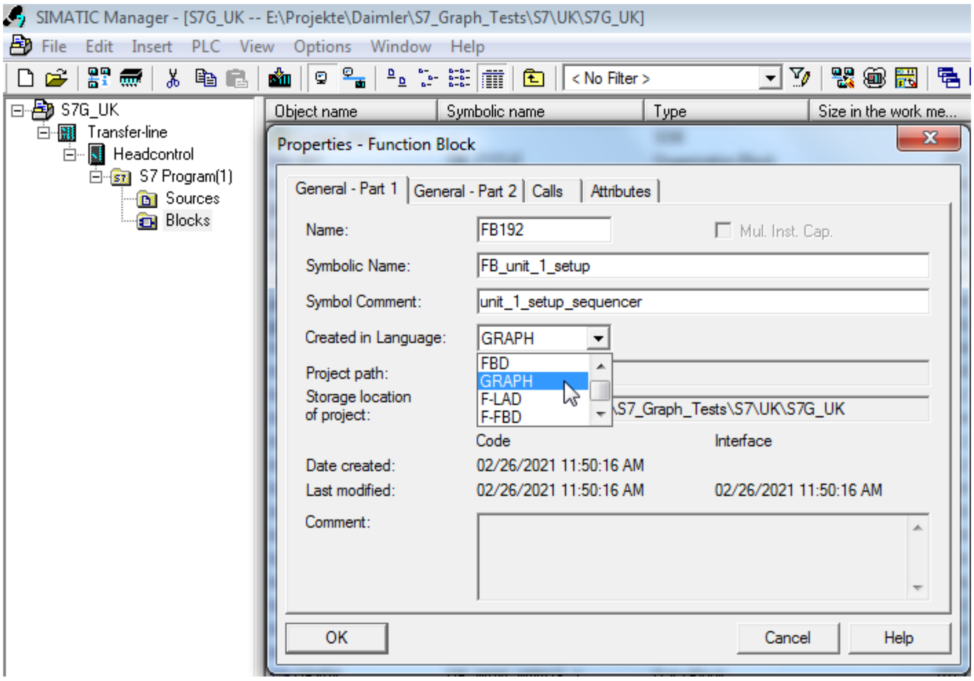


Fig. 108: Symbolic name of the step sequence block

Note	A maximum of 24 characters can be entered.

6.6.1.6 Call of the step sequence block

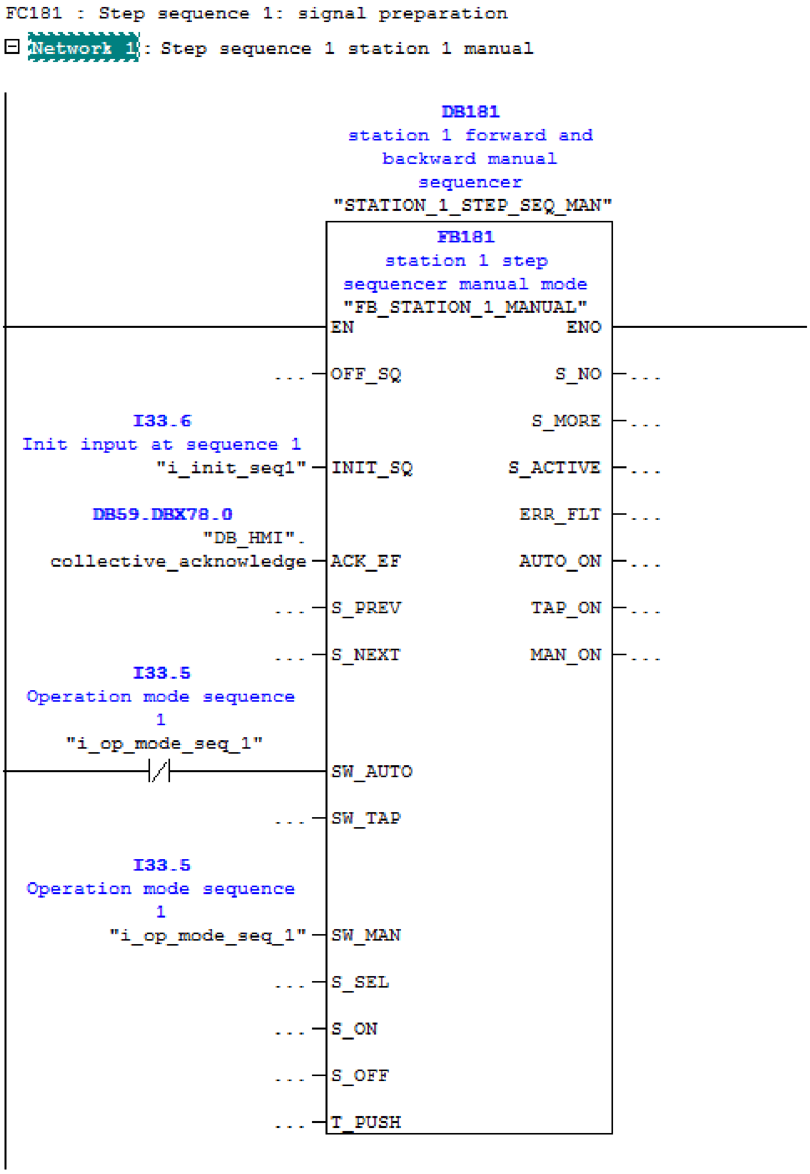


Fig. 109: Example call of the step sequence block

6.6.1.7 Programming the outputs of a motion

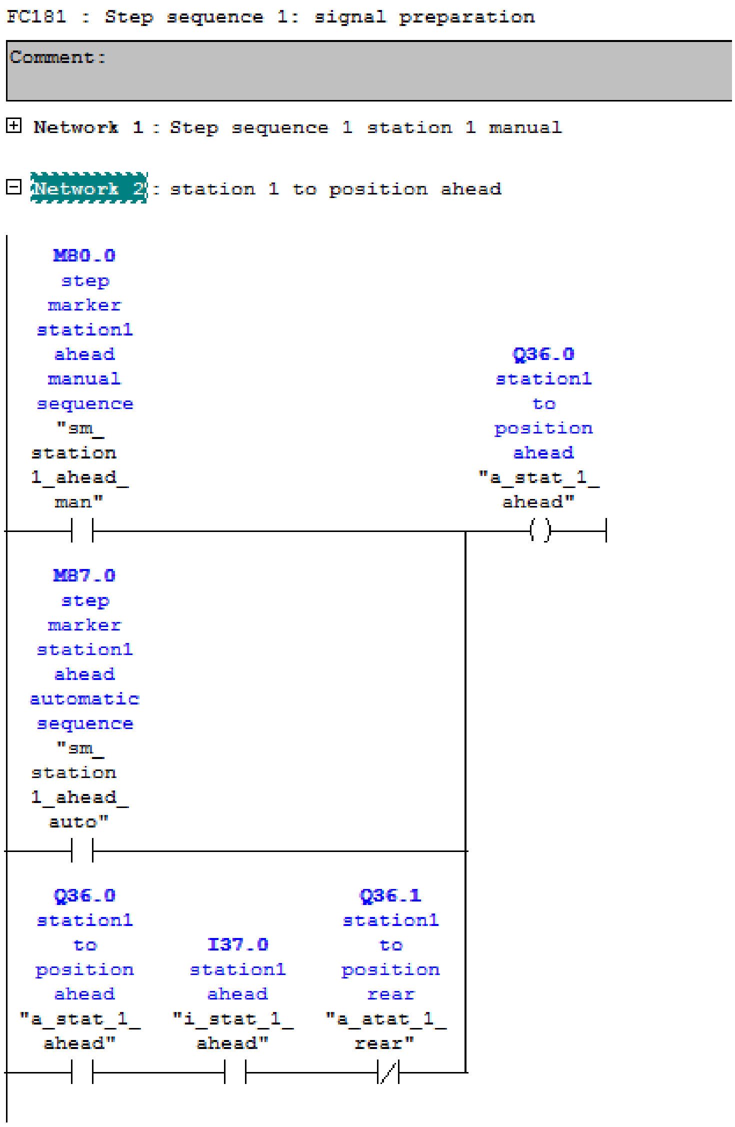


Fig. 110: Programming the outputs

6.6.1.8 S7 GRAPH application setting

Note	Changes in the application settings are always used as default settings for the newly created blocks.

All the following changes and specifications for the block settings can also be configured as default settings for the newly created blocks in the application settings.

6.6.1.9 Block setting of the step sequence

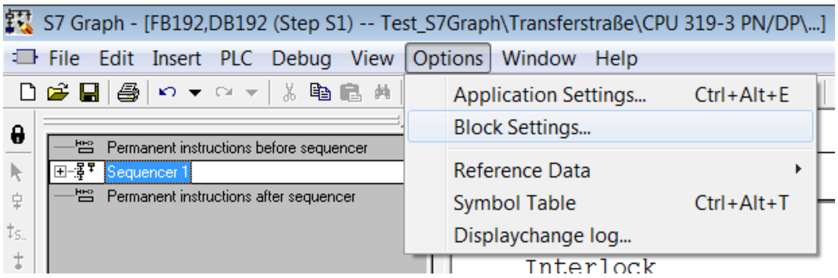


Fig. 111: Selecting the S7 GRAPH block setting

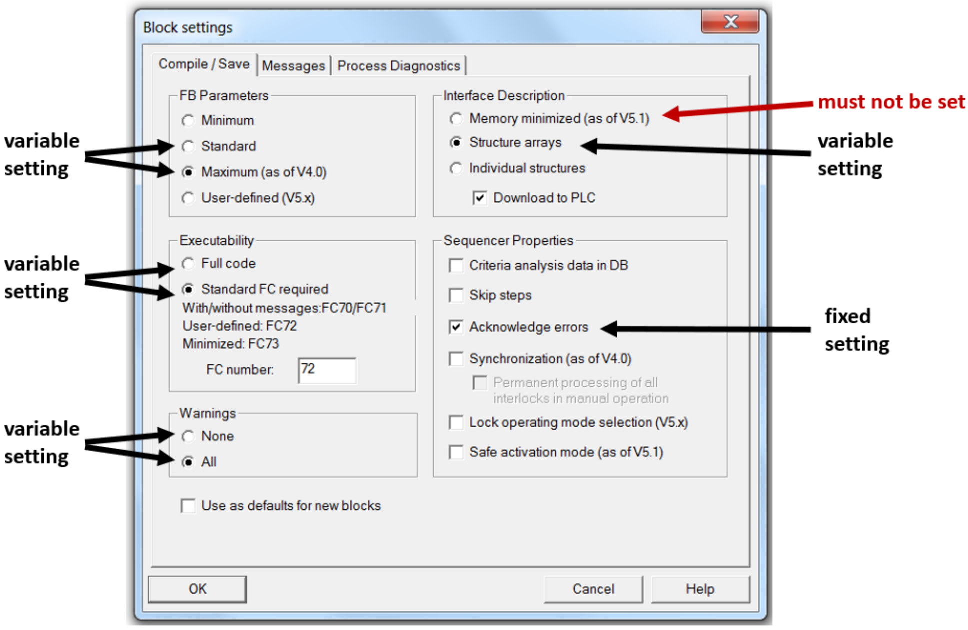


Fig. 112: S7 GRAPH block settings

FB parameter

Parameter sets of the FB	Description
Minimum	Only the SQ_INIT start parameter is available and can be written. TRUE = Parameterization error
Standard	The standard parameters are available and can be supplied.
Maximum (as of V4.x):	An extended standard parameter set is available and can be supplied.
User-defined/extended (as of V5.x):	All parameters are available and those not required can be deleted. User-specific parameters can also be defined.

Table 40: S7 GRAPH – FB parameters

Note	The parameter set can either be set to **Standard** or Maximum!

Executability

Options for executability	Description
Independently executable	If you select this option, the entire code relevant for the execution is integrated in each S7 GRAPH FB.
Standard FC required (>=V4.x)	If you select this option, S7 GRAPH uses a standard FC (FC70, FC71, FC72 or FC73), which contains the majority of the code for all FBs. Enter the FC number of the required FC in the field.

Table 41: S7 GRAPH – Options for executability

Note	The specification of the executability is variable. However, if "Standard FC required" is activated, then FC72 must be entered as the standard FC!

Warnings

Options for warnings	Description
None	Warnings that occur during the compilation are not displayed (has no effect on the display of errors).
All	All alarms that occur during the compilation are displayed in the message window.

Table 42: S7 GRAPH – Options for warnings

Note	The specification of the warnings is variable!

Interface description

Options for interface description	Description
Minimized memory space	The interface descriptions are stored in the instance DB as structures. A separate structure with the main information is created for each step and each transition of the sequence. This option reduces the memory requirement of the S7 GRAPH FB significantly. However, the created blocks are not diagnostics-capable and they do contain a status display for conditions when monitoring the sequential control. If you use this option, you must use the supplied FC73 standard block.
Structure arrays	The step descriptions are stored in the instance DB as arrays (ARRAY). This option optimizes the memory requirement of your S7 GRAPH function block. However, the step names are not saved. In this case, a symbolic addressing from other blocks is not possible.
Individual structures	The step descriptions are stored in the instance DB as structures (STRUCT). A separate structure with detailed information is created for each step and each transition of the sequence. In this way, internal and external access is easy via symbolic names. The instance DB can be evaluated via direct access to the data arrays and also via the step and transition names. The created structures extend the instance DB, but have no effect on the performance during the processing of the sequence.
Load to AS	If you select this option, the interface description is also loaded to the target system when you load an FB with S7 GRAPH. In this way, you can recompile the block in a PG on which the correct project structure is not available.

Table 43: S7 GRAPH – Options for interface description

Important	The "Minimized memory space" specification is not permitted!

Note	The "Structure arrays" or "Individual structures" specification is variable!

Sequencer properties

Options for sequencer properties	Description
Criteria analysis data in the DB	The information required for a criteria analysis is written to the instance DB.
Skip steps	Activates the "Skip steps" function.
Acknowledgment required for errors	If a monitoring error occurs during operation (supervision condition fulfilled), it must be acknowledged via the "ACK_EF" input parameter

	so that the control can continue to run. This option cannot be selected if you activated the option "FB parameters: minimum".
Synchronization (>=V4.x)	Enables the synchronization between the program and the process.
Permanent processing of all interlocks during manual operation	If you select this option, all interlocks can be permanently processed during manual operation During operation, a missing interlock and therefore the faulted step is indicated in the status display.
Mode selection disable (V5.x)	If you activate this parameter, it is no longer possible to change the operating mode from the PG or the OP (e.g. in the "Control sequence" dialog box).
Safe switching behavior (V5.1)	When a step is activated, all other steps that cannot be active at the same time as the step to be activated because of the sequence structure, are found and deactivated. If, for example, a step is to be activated in an alternative branch, all steps in the other alternative branches are deactivated first.

Table 44: S7 GRAPH – Options for sequencer properties

Note	The "Acknowledgment required for errors" must be selected!

Required block setting for manual step sequence

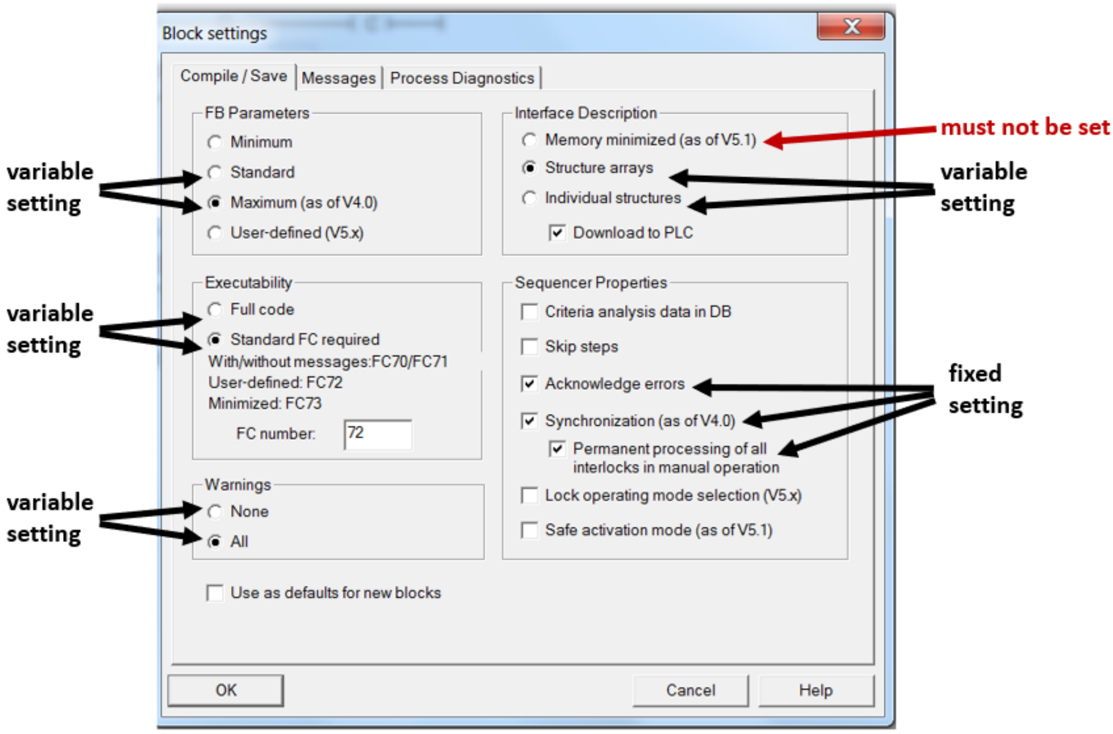


Fig. 113: S7 GRAPH – Block settings for manual step sequence

Note	For diagnostic reasons, the "Synchronization" and the "Permanent processing of all interlocks during manual operation" options must be selected!

6.6.1.10 Activating the step sequence diagnostic function

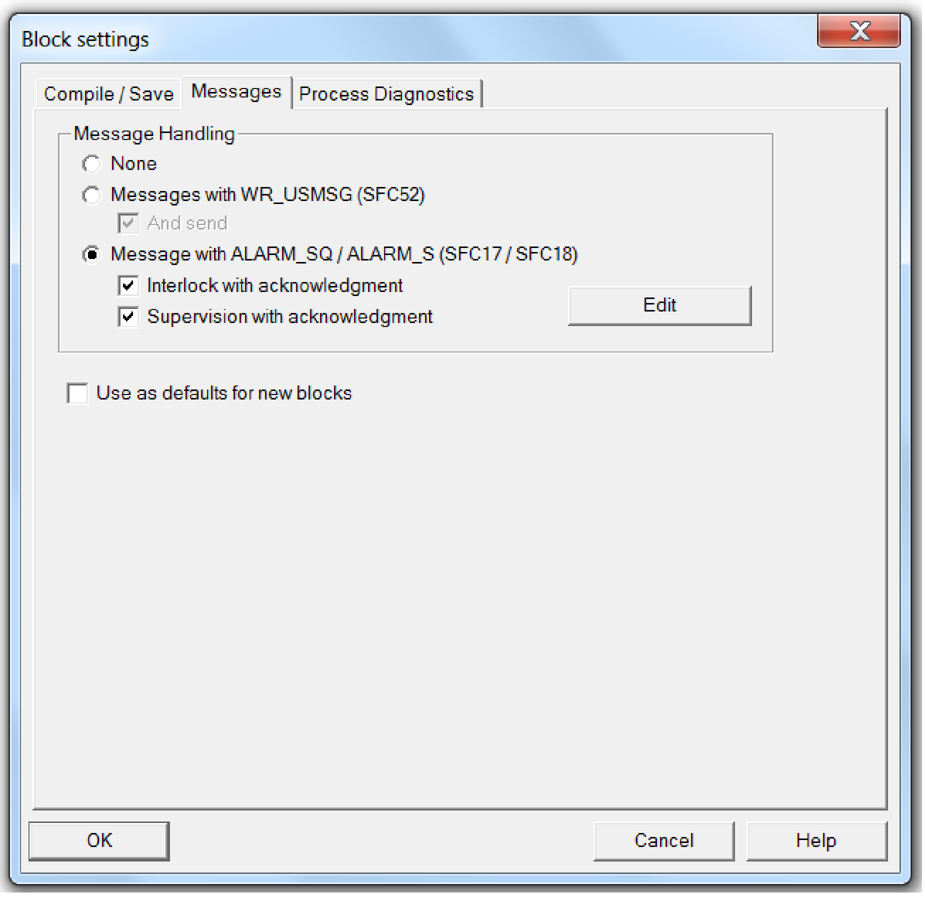


Fig. 114: Activating the step sequence diagnostic function

In order to save the sequence so that it is diagnostics capable, in the Block Settings

dialog box, on the Messages tab, Reporting using

ALARM_SQ/ALARM_S (SFC17/SFC18) must be selected and acknowledged with OK.

You can now save the sequence. The instance DB is generated and

the information for the diagnostics is generated.

Important	It is not enough to generate a new instance DB via the File > Generate instance DB.... menu. The diagnostics information is only created when the sequence FBs are created!

Note	If you want to make an existing sequence FB diagnostics capable, delete the associated instance DB, open the sequence FB and then save it. (On saving, the

	text "Generating PDIAG information.." appears in the status line of the S7 GRAPH input screen).

6.6.1.11 Symbolic name of the step sequence data block

The step sequence function should be described by the input of the step sequence data block symbol because the symbol is displayed in the "Diagnostics Overview" and the "Detail Diagnostics" screens.

The symbolic name of the data block is also relevant for the error evaluation in PRISMA.

S7 Program(1) (Symbols) -- S7G_UK\Transfer-line\Headcontrol

	Status	Symbol	Addres	Data type	Comment
21		STATION_1_STEP_SEQ_MAN	DB 181	FB 181	station 1 forward and backward manual sequencer
22		COOLANT_STEP_SEQ_MAN	DB 183	FB 183	coolant step sequencer manual mode
23		COOLANT_STEP_SEQ_AUTO	DB 189	FB 189	coolant step sequencer automatic mode

Fig. 115: Symbolic names of the step sequence data blocks

Note	A maximum of 24 characters can be entered.

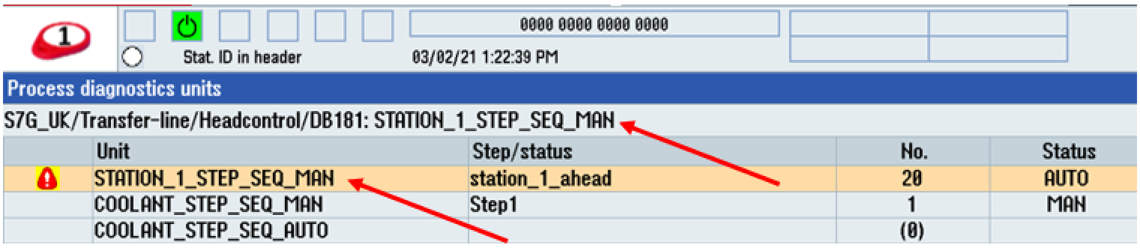


Fig. 116: Display of the data block symbol in the Diagnostics Overview screen

6.6.1.12 Text assignments in the step sequences

The text assignments that must be observed for diagnostics reasons are described in the following.

Step name

When creating a new step, the step name is automatically designated with a default text. This must be changed to a meaningful name that describes the function of the step.

The step name can be changed in the respective step.

Note	A maximum of 24 characters can be entered.

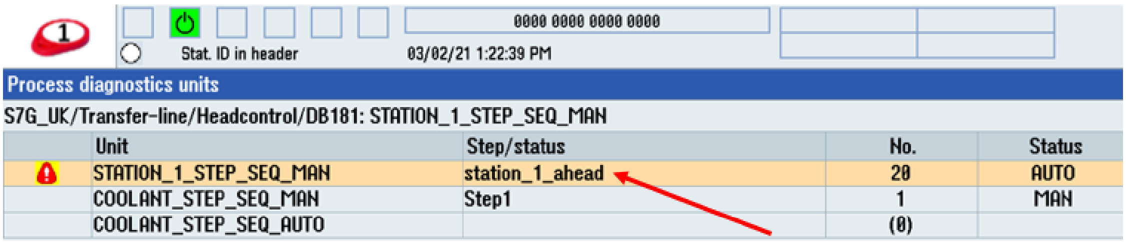


Fig. 117: Display of the step name in the Diagnostics Overview screen

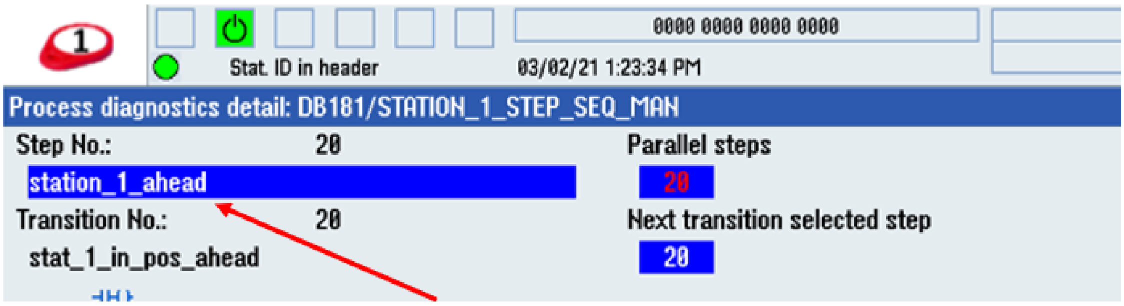


Fig. 118: Display of the step name in the Detail Diagnostics screen

Transition names

The transition name is assigned automatically by the system

(range: Trans1 ... Trans999).

It can comprise maximum 24 alphanumeric characters, wherein the first character must be a letter. However, if the zoom factor is too small, the display of the transition name is deactivated.

You can change the transition name in the "Transition Properties" dialog box.

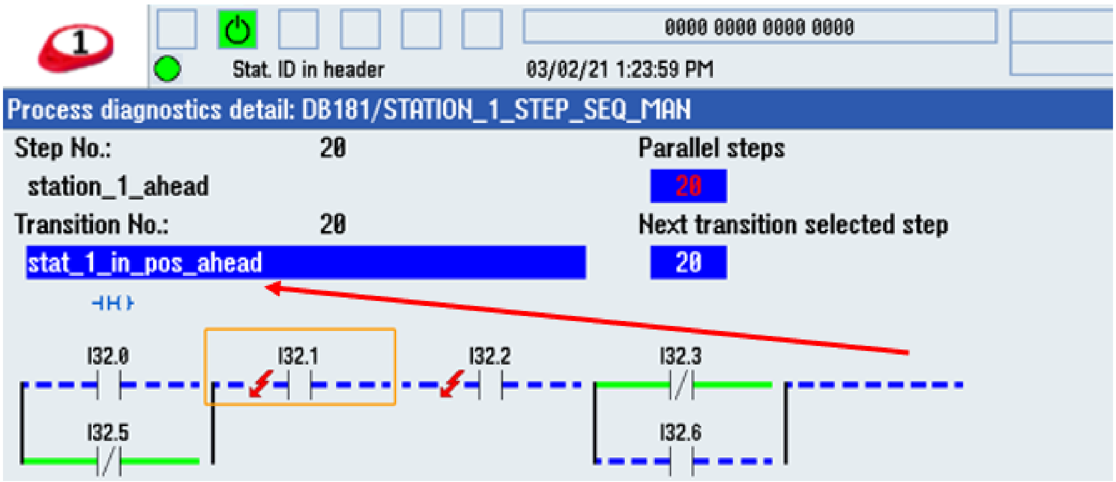


Fig. 119: Display of the transition name in the Detail Diagnostics screen

6.6.1.13 Programming of step interlock and step monitoring

Step interlock

An interlock is a programmable condition for the step interlock that influences the execution of individual actions.

If the logic operation of the conditions is fulfilled, actions linked to the interlock are executed.

If the logic operation of the conditions is not fulfilled, a fault is present:

- Actions linked to the interlock are not executed.
- An interlock error is signaled (event L1)

You can program an interlock in the Single step display type. Maximum 32 LAD or FBD elements can be programmed for each interlock. The result of the logic operation is managed automatically by the system.

A programmed interlock is indicated in each display type by the letter C to the left of the step.

Notice	If you program a step interlock, it is not used in the actions until the operations are extended with the letter C.

An interlock without a condition (i.e. without an LAD or FBD element) behaves like a fulfilled interlock.

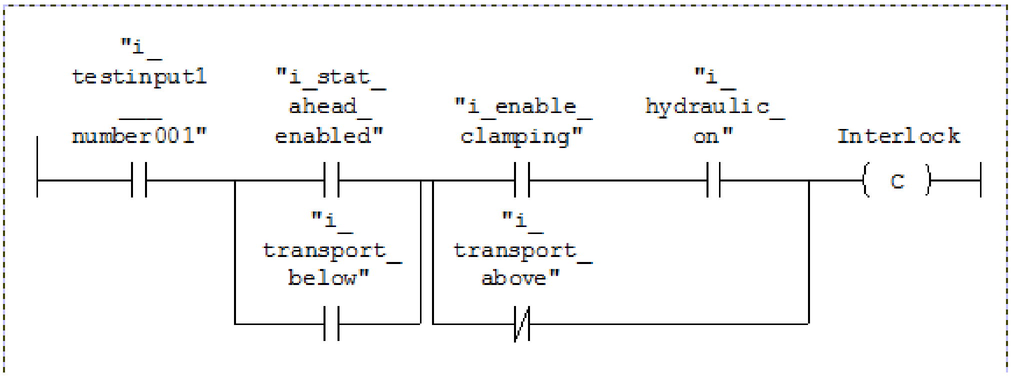


Fig. 120: Programming a step interlock

Note	The interlock must not be queried step-wide!

Step supervision

A supervision is a programmable condition for the step monitoring that influences the advance from one step to the next.

A programmed supervision is indicated in each display type by the letter V to the left of the step.

You can program supervisions in the Single step display type. Maximum 32 LAD or FBD elements can be programmed for each supervision. The result is managed automatically by the system.

If the logic operation of the conditions is fulfilled, a fault is present and event V1 is signaled. The sequencer does not advance to the next step. The current step remains active however. The step activation time Si.U is stopped when the condition is fulfilled.

If the logic operation of the conditions is not fulfilled, a fault is not present. If the following transition is fulfilled, the sequencer advances to the next step.

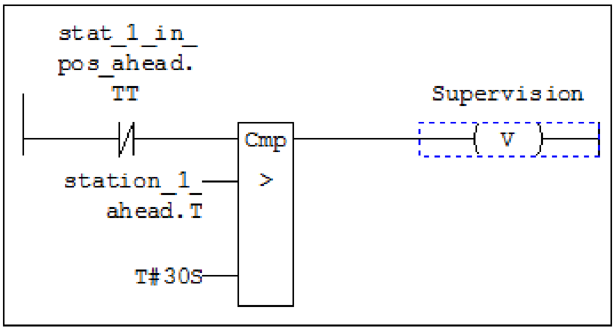


Fig. 121: Programming a step supervision

6.6.1.14 Changing the standard message texts for Alarm_S messages

Standard message text specification in S7 GRAPH

Every time a new data block is generated by S7 GRAPH, standard entries are specified for the supervision and interlock error message text specifications.

They comprise two parts:

1. Text specification in the application setting
   Interlock: or Supervision Fault:
2. Additional default entries of S7 GRAPH
   FB181,DB181, S@1W%03u@ @1W%t#S7GraphFB181@

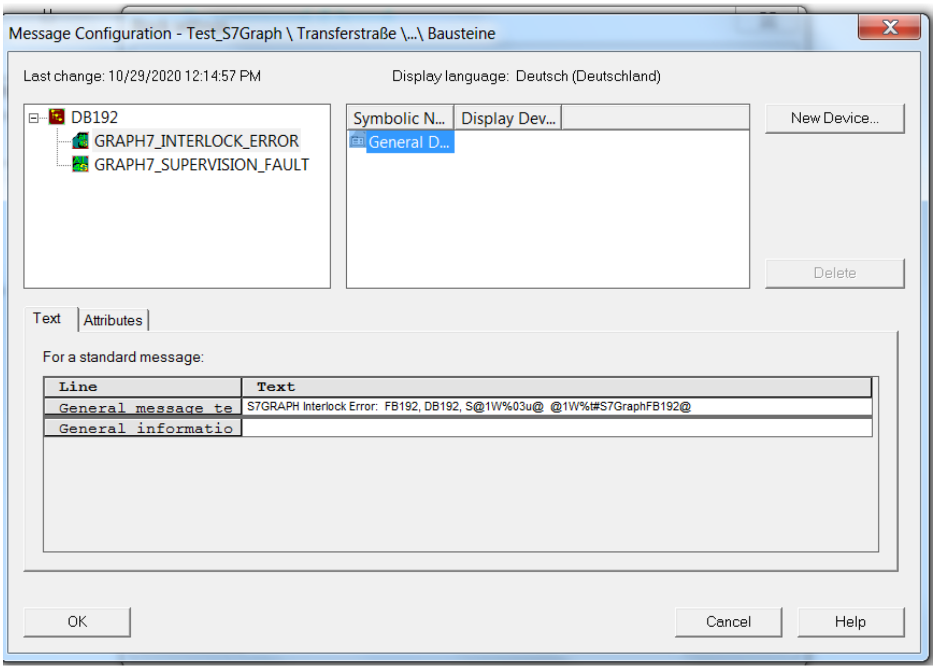


Fig. 122: Standard interlock error message text

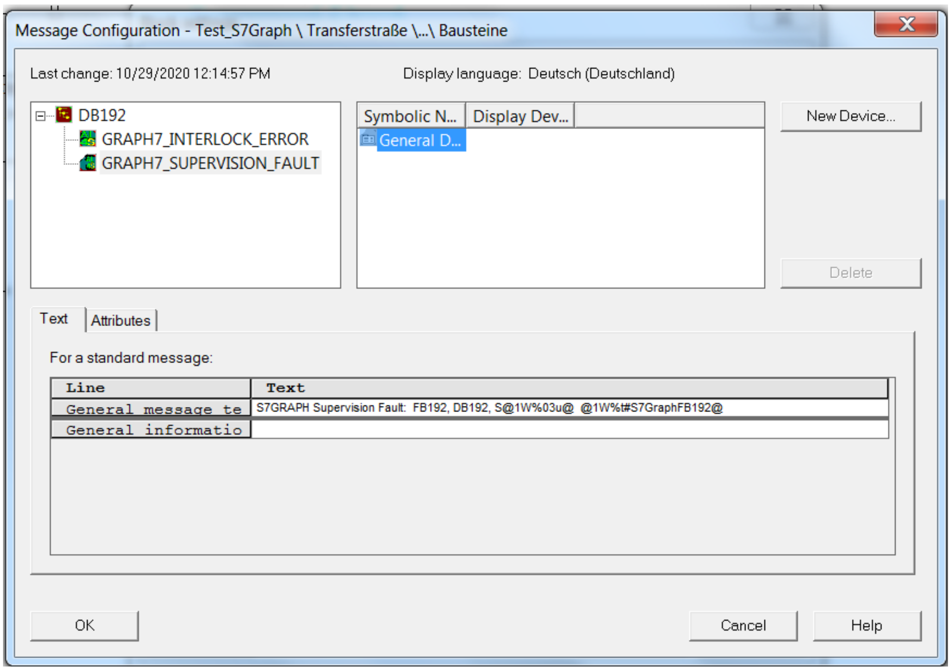


Fig. 123: Standard supervision error message text

Changing the message text specification in S7 GRAPH

Changing the message text specification improves the error display and simplifies the error analysis.

Text change in the application settings

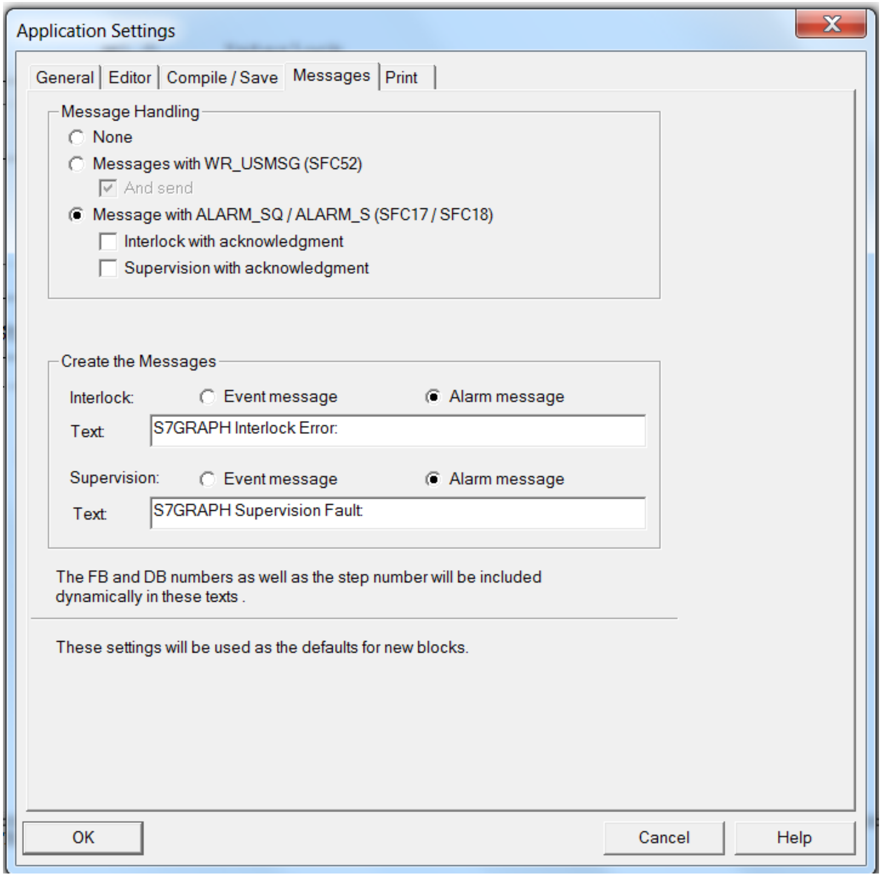


Fig. 124: Standard error message text in the application settings

The specifications are to be changed on the following entries:

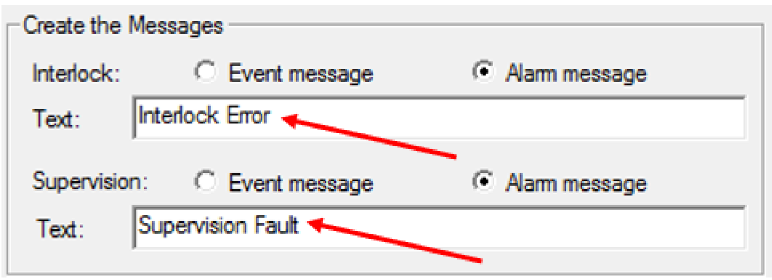


Fig. 125: Changed error message texts in the application settings

Text change in the block settings

The following changes must be made separately for each block.

Entry of the function designation instead of FB181, DB181:

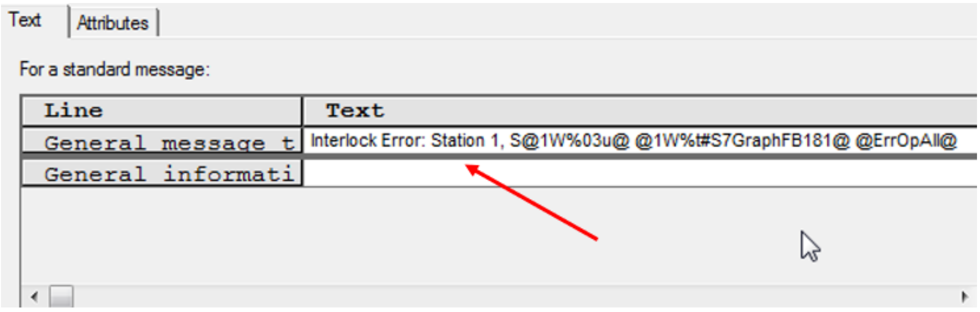


Fig. 126: Function designation in the error message texts

The following entries, the dynamic display of the step number and the dynamic display of the step name extension are not changed.

The new entry @ErrOpAll@ is added at the end.

@ErrOpAll@	Display of the absolute operands, symbols and comments of all faulty operands

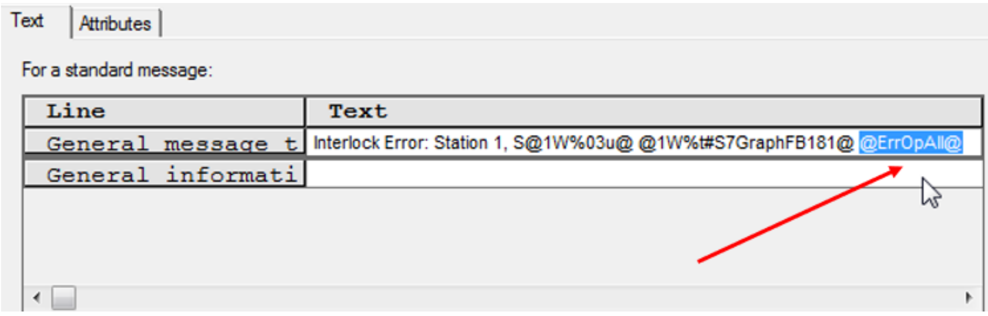


Fig. 127: Adding @ErrOpAll@ in the error message texts

These changes must also be made for the supervision faults.

Display of the error messages in the fault screen of HMI PRO

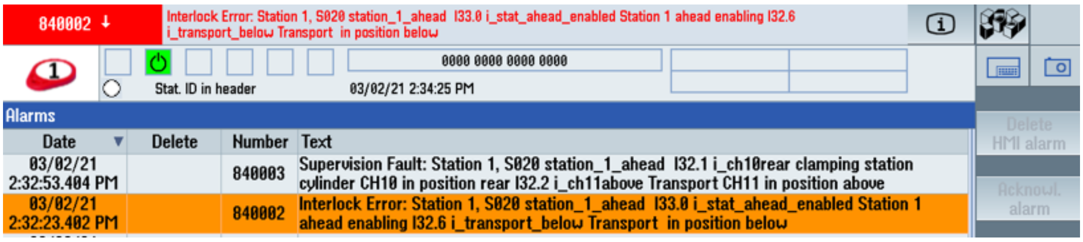


Fig. 128: Display of the error messages in the fault screen of HMI PRO

Display of the faulty operands in the Detail Diagnostics screen of HMI PRO

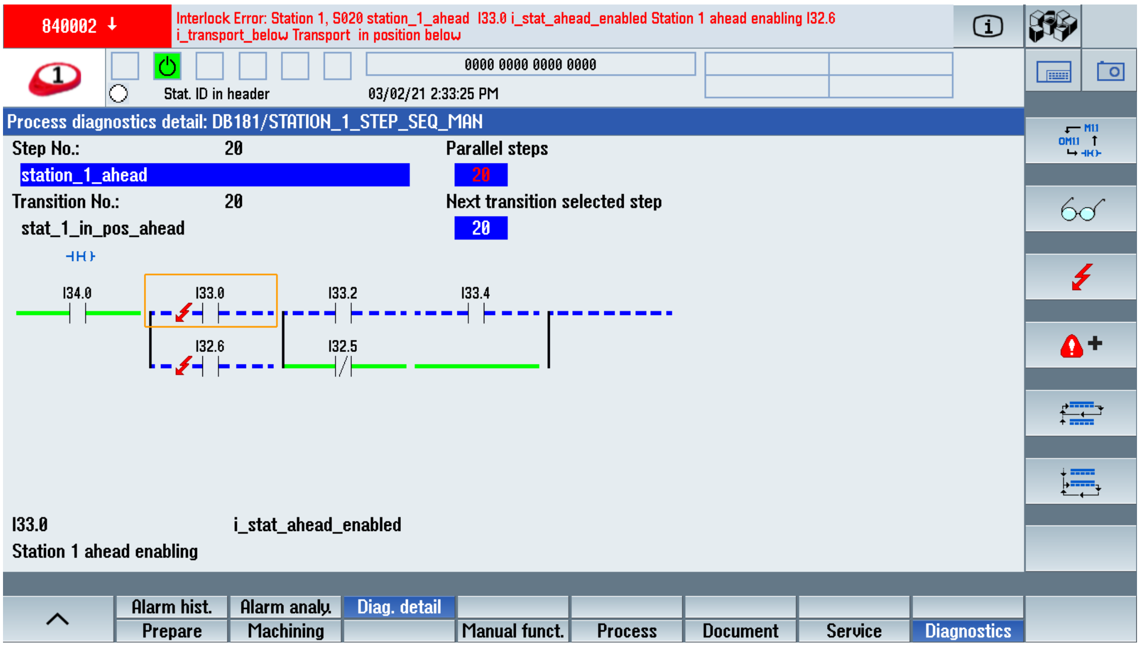


Fig. 129: Display of the faulty operands in the Detail Diagnostics screen of HMI PRO

STL source file for backup of the changed alarm text specifications in the Step7 project

An STL source file for backup of the changed alarm text specifications of the S7 GRAPH blocks in the STEP 7 project can be created. The advantage is that, when required, the changed alarm text specifications can be copied from the STL source file to the respective alarm text specifications of the S7 GRAPH block.

Note	Every time a new data block is generated by S7 GRAPH, standard entries are specified for the supervision and interlock error message text specifications.

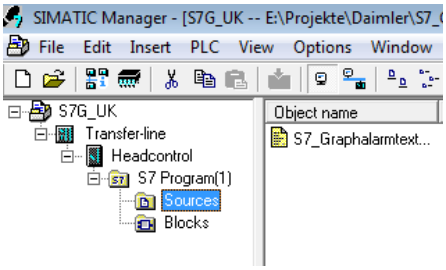


Fig. 130: Selecting the source folder

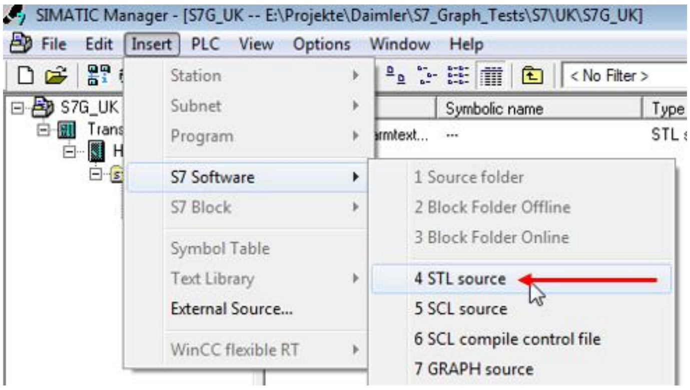


Fig. 131: Inserting an STL source file

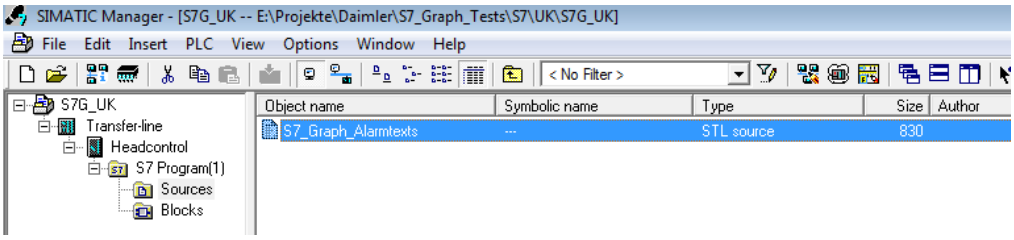


Fig. 132: Name assignment of the STL source file

6.6.1.15 Creating function group-related step sequence blocks for NC systems

A separate step sequence must be configured for the automatic sequence and for the manual functions for each function group, e.g. unit, coolant, clamping station and transport.

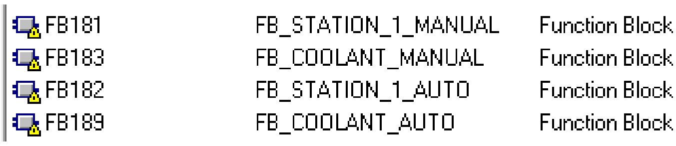


Fig. 133: Example of function group-related step sequences

6.6.1.16 Structure of the function group-related step sequence blocks for NC systems

A separate step sequence must be programmed for each individual function in the function group-related step sequence blocks. The function of the individual step sequence should be descried via the block comment.

```
Step Sequencer Coolant

Sequencer 1 - low pressure spindles
Sequencer 2 - high pressure spindle 1
Sequencer 3 - high pressure spindle 2
Sequencer 4 - flush workpiece
Sequencer 5 - clean filter
```

Fig. 134: S7 GRAPH – Example of a block comment

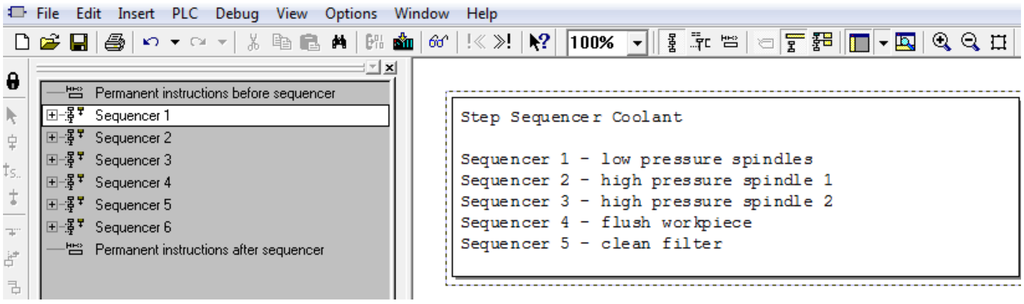


Fig. 135: S7 GRAPH – Example of coolant, automatic

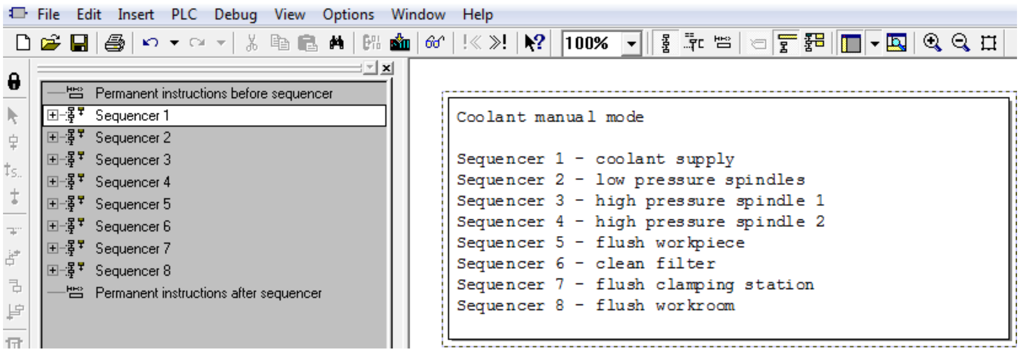


Fig. 136: S7 GRAPH – Example of coolant, manual functions

6.6.1.17 NC-specific step sequences

In NC-specific step sequences, the motion requirements are programmed in the A/B direction. A termination of the motion and the limit monitoring of the individual positions are also monitored.

The respective selection/deselection are triggered via M commands and transferred to the step sequence via a data block as data interface.

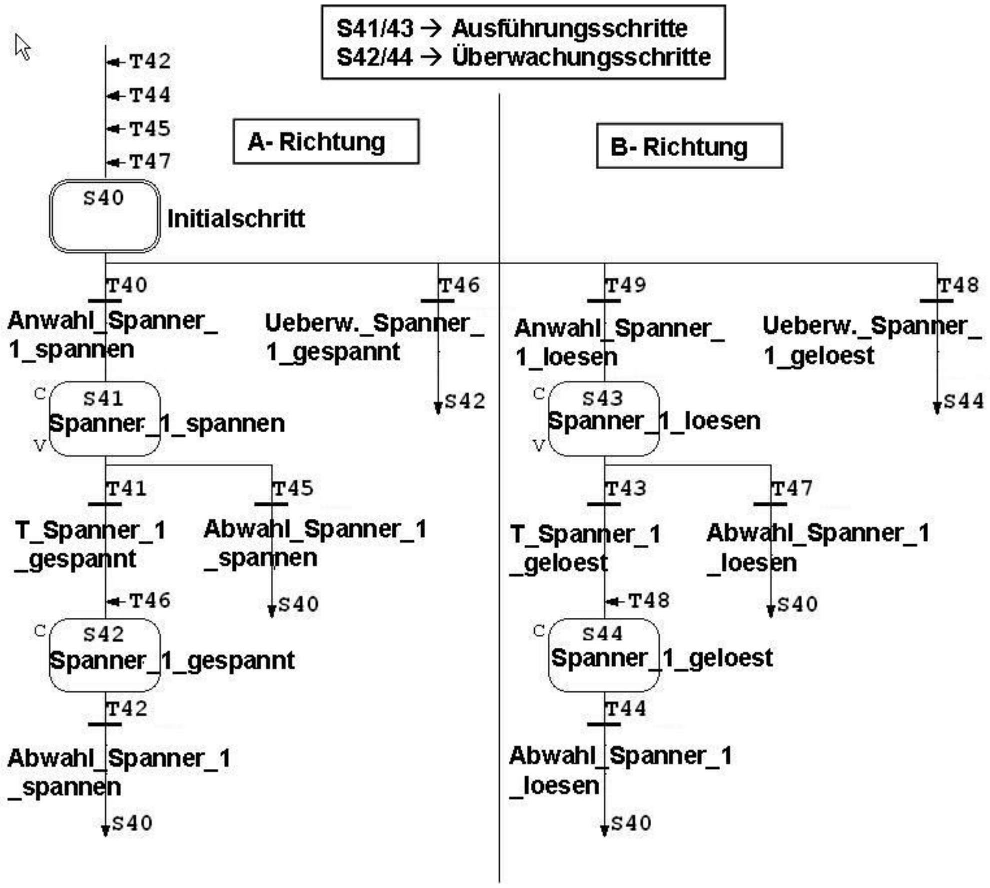


Fig. 137: S7 GRAPH – Example of clamping/releasing clamp 1

Note	If only one direction is required, the configuration of the B direction can be omitted.

Note	Pair errors must be programmed conventionally outside the step sequence!

6.6.2 Description of the S7 GRAPH Transline blocks

6.6.2.1 "FB_MAN_SELECT" FB452 (V2.8)

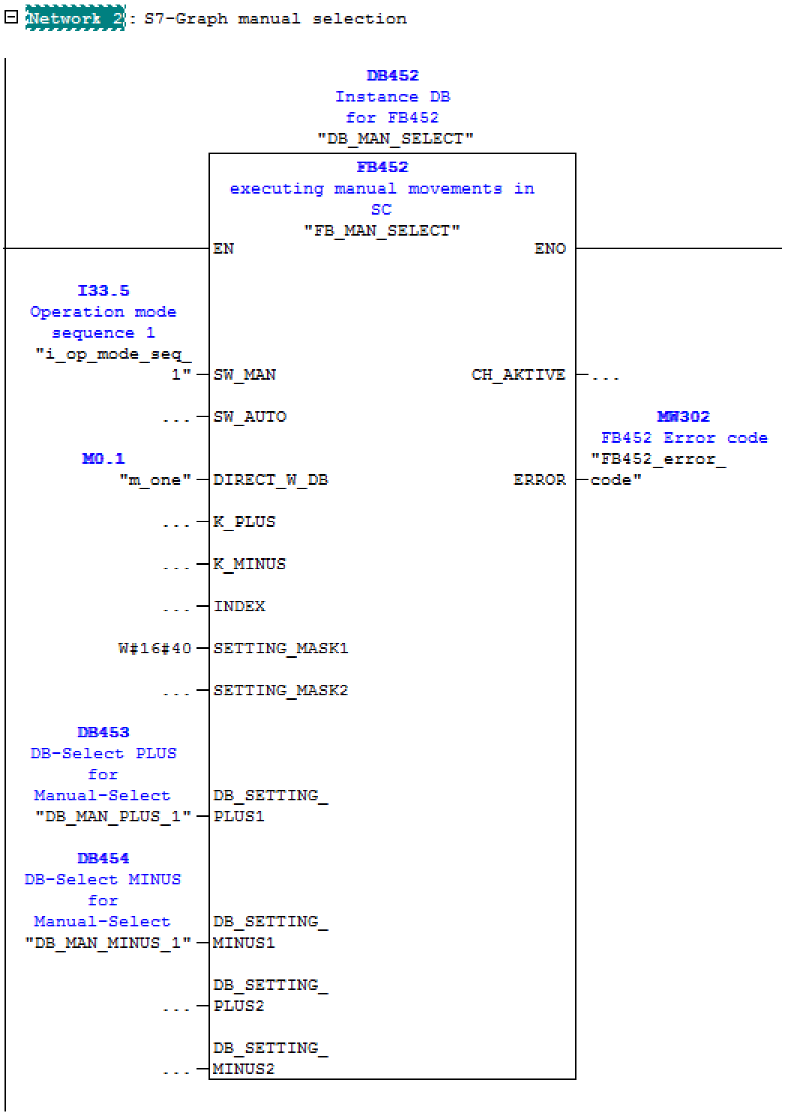
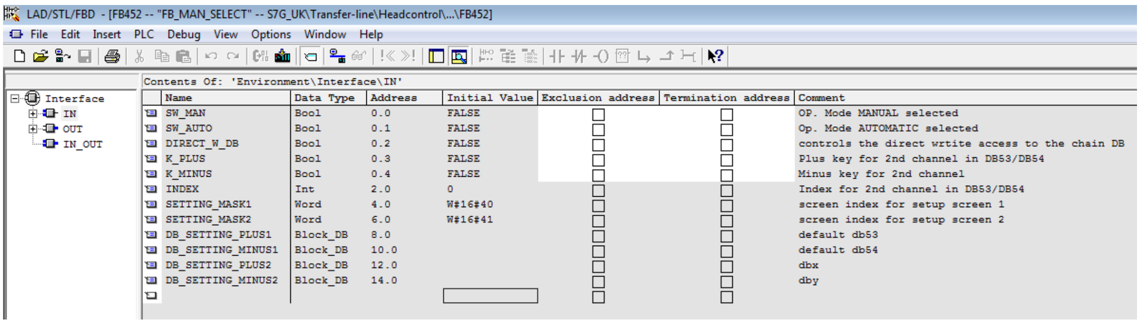


Fig. 138: "FB_Man_Select" FB452



Name	Data Type	Address	Initial Value	Exclusion address	Termination address	Comment
SW_MAN	Bool	0.0	FALSE			OP. Mode MANUAL selected
SW_AUTO	Bool	0.1	FALSE			Op. Mode AUTOMATIC selected
DIRECT_W_DB	Bool	0.2	FALSE			controls the direct wrtite access to the chain DB
K_PLUS	Bool	0.3	FALSE			Plus key for 2nd channel in DB53/DB54
K_MINUS	Bool	0.4	FALSE			Minus key for 2nd channel
INDEX	Int	2.0	0			Index for 2nd channel in DB53/DB54
SETTING_MASK1	Word	4.0	W#16#40			screen index for setup screen 1
SETTING_MASK2	Word	6.0	W#16#41			screen index for setup screen 2
DB_SETTING_PLUS1	Block_DB	8.0				default db53
DB_SETTING_MINUS1	Block_DB	10.0				default db54
DB_SETTING_PLUS2	Block_DB	12.0				dbx
DB_SETTING_MINUS2	Block_DB	14.0				dby

Fig. 139: "FB_MAN_SELECT" IN parameter

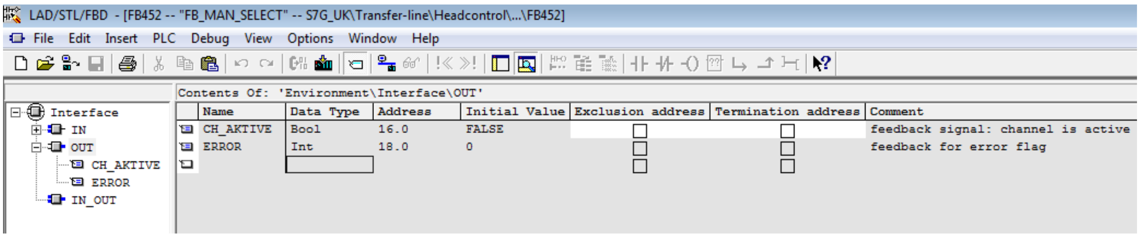


Fig. 140: "FB_MAN_SELECT" OUT parameter

Description

The "FB_MAN_SELECT" function block (FB452/DB452) establishes the connection between the setup screen and the step sequence. The assignment of the setup screen or motion selection to the step sequence /step number is entered in "DB_MAN_PLUS_1" (DB453) for motion in the + direction and in "DB_MAN_MINUS_1" (DB454) for motion in the - direction. The assignment of the motion number to the step sequence/step number can be variable.

The entry or assignment of the "Step no." and "Step sequence DB no." is performed by the user.

Function

Read-out of the "Setup screen" function number from "DB_HMI".function_no_low or function_no_high, then, depending on the plus/minus key, "DB_HMI".motion_plus (DBX87.4) or "DB_HMI".motion_minus (DBX87.5), the "Step no." and "Step sequence DB no." are read from "DB_MAN_PLUS_1" (PLUS) or "DB_MAN_MINUS_1" (MINUS).

Then the step sequence is deactivated with "OFF_SQ" and the step number is entered in the appropriate step sequence data block.

After the step number activation (feedback from the step sequence), the step sequence is activated with "S_ON". The step is then active. If the plus/minus key is pressed, the step is deactivated.

If parameter "DIREKT_S_DB" = FALSE is used, the appropriate control bits "OFF_SQ" and "S_ON" must then be ORed for the corresponding step sequence FB.

If parameter "DIREKT_S_DB" = TRUE is used, these control bits are entered directly in the corresponding step sequence FB. The control bits then do not have to be ORed.

Note	Parameter "DIREKT_S_DB" must be assigned a static result of logic operation! After selecting the direct/indirect method, the configuration engineer must assign this input a static result of logic operation! The "DIREKT_S_DB" input must not change its state during the program runtime!

The first channel is controlled via the setup screen with the plus/minus key and the cursor position = index number in the "DB_MAN_PLUS_1"/"DB_MAN_MINUS_1" blocks.

The screen number, cursor position and the plus/minus key are taken from the "DB_HMI". The second channel is controlled directly via the new parameters of the "FB_MAN_SELECT".

The "INDEX" number (decimal!) is used to preselect the index from 1-256 in the "DB_MAN_PLUS_1"/"DB_MAN_MINUS_1", and the key selection is triggered via the "TPLUS"/"TMINUS" parameter. Both channels have equal priority. If a channel is activated, it remains active as long as the plus/minus key or "TPLUS"/"TMINUS" has RLO = 1. A channel then becomes inactive if the plus/minus key is released or "TPLUS"/"TMINUS" has RLO = 0.

If a channel is active, the signals of the other channel are ignored. In order to be able to activate a channel, first both signals "TPLUS" and "TMINUS" must have RLO = 0 and the plus and minus keys in the setup screen must not be actuated.

If the second channel is not required via "TPLUS"/"TMINUS", both inputs must be supplied with a static ZERO signal (e.g. zero bit memory). The INDEX parameter then does not have to be supplied!

The "K_AKTIV" parameter signals back whether a channel is active. If "K_AKTIV" = TRUE, a channel is currently activated. The number of the channel can be taken from the instance DB of the "FB_MAN_SELECT".

A motion can only be activated when the data "DB_HMI".P_plus or "DB_HMI".P_minus and "DB_HMI".motion_plus or "DB_HMI".motion_minus have been assigned the "1" signal. The data bits "P_plus" and "P_minus" must be assigned values by the Siemens standard blocks, the data bits "motion_plus" and "motion_minus" must be assigned values by the user.

Note	The static variable "ichan_selector" contains the channel number 0 No channel is selected, "K_AKTIV" = FALSE 1 "TPLUS"/"TMINUS" channel is selected, "K_AKTIV" = TRUE 2 Setup screen channel is selected, "K_AKTIV" = TRUE

Parameter description

Note	The "HMI PRO" data block is read from "MMC.DB_HMI_PRO" DB19.DBW128.

Parameter	Data type	Description
SW_MAN	BOOL	MANUAL TRANSLINE mode selected
SW_AUTO	BOOL	AUTO TRANSLINE mode selected
DIREKT_S_DB	BOOL	Controls the direct writing in the sequence DB
TPLUS	BOOL	Plus 2 channel key
TMINUS	BOOL	Minus 2 channel key
INDEX	INT	Index for 2nd channel in "DB_MAN_PLUS_1"/"DB_MAN_MINUS_1"
BILD_NR1	WORD	Number of setup screen 1
BILD_NR2	WORD	Number of setup screen 2
DB_HAND_PLUS1	BLOCK_DB	Number of the data block for plus motion in setup screen 1
DB_HAND_MINUS1	BLOCK_DB	Number of the data block for minus motion in setup screen 1

DB_HAND_PLUS2	BLOCK_DB	Number of the data block for plus motion in setup screen 2
DB_HAND_MINUS2	BLOCK_DB	Number of the data block for minus motion in setup screen 2
K_AKTIV	BOOL	Feedback, a channel is active
ERROR	INT	Error code description (VAR "ERROR"): Code 0 No error Code 1 No step sequence DB entered in "DB_MAN_PLUS_1" Code 2 No step number entered in "DB_MAN_PLUS_1" Code 3 No step sequence DB entered in "DB_MAN_MINUS_1" Code 4 No step number entered in "DB_MAN_MINUS_1"

Fig. 141: FB_MAN_SELECT – Parameter description

Structure of DB453/DB454/DB455 and DB456

Structure of "DB_MAN_PLUS_1" (DB453), "DB_MAN_MINUS_1" (DB454), "DB_MAN_MINUS_2" (DB455), DB_MAN_MINUS_2" (DB456)

Group	Movement	Data word	Type	Comment
1	1	DBW0	INT	Step no., motion 1
1	1	DBW2	INT	Step sequence DB no.
1	1	DBX4.0	BOOL	s_on (step sequence on)
1	1	DBX4.1	BOOL	off_sq (step sequence off)
1	2	DBW6	INT	Step no., motion 2
1	2	DBW8	INT	Step sequence DB no.
1	2	DBX10.0	BOOL	s_on (step sequence on)
1	2	DBX10.1	BOOL	off_sq (step sequence off)
1	3	DBW12	INT	Step no., motion 3
1	3	DBW14	INT	Step sequence DB no.
1	3	DBX16.0	BOOL	s_on (step sequence on)
1	3	DBX16.1	BOOL	off_sq (step sequence off)
:	:	:	:	:
:	:	:	:	:
:	:	:	:	:
1	256	DBW1530	INT	Step no., motion 256
1	256	DBW1532	INT	Step sequence DB no.
1	256	DBX1534.0	BOOL	s_on (step sequence on)
1	256	DBX1534.1	BOOL	off_sq (step sequence off)

Table 45: Structure of DB453/454/455/456

Name	Type	Comment
s_nr	INT	Step No.
sk_db_nr	INT	Step sequence no.
s_on	BOOL	Control signals

off_seq	BOOL	Control signals

Table 46: Design of the UDT1

6.6.2.2 "FB_EXECUTABLE" FB451 (V2.3)

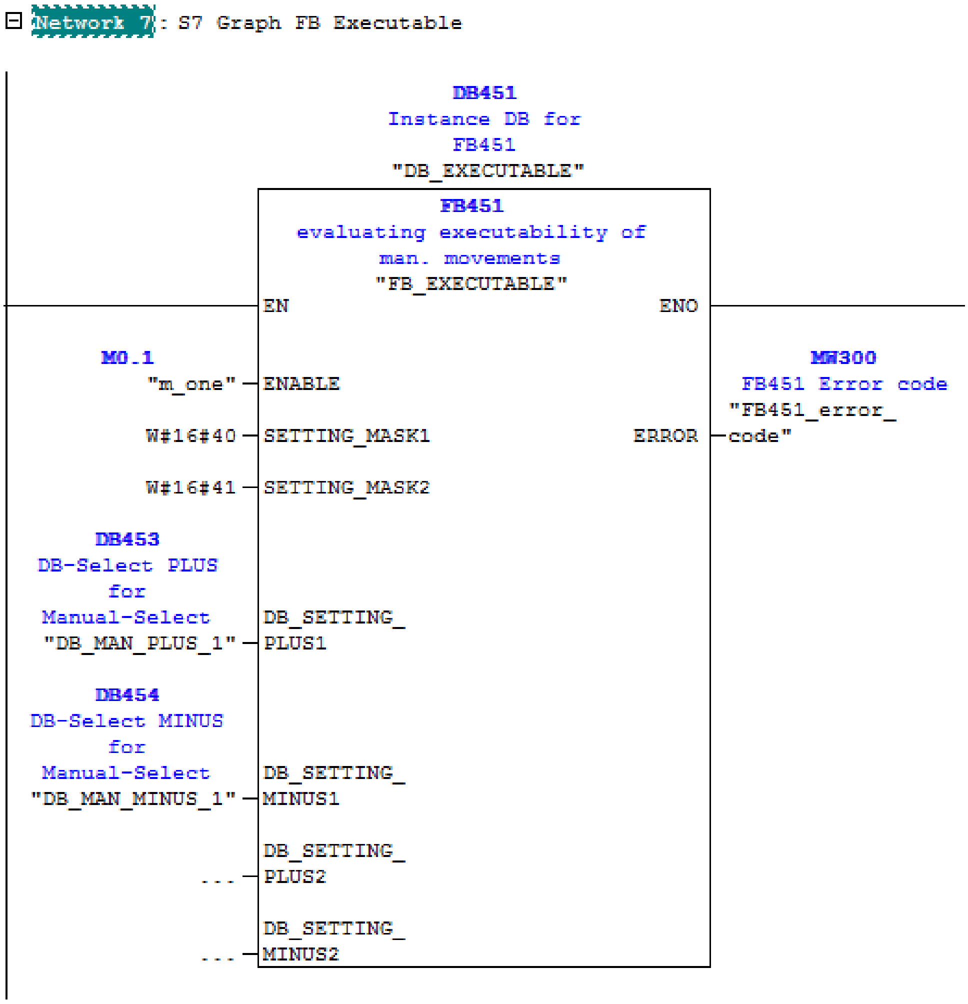
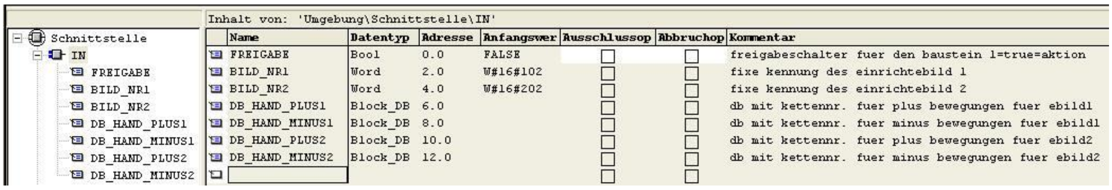


Fig. 142: "FB_EXECUTABLE" FB451



Inhalt von: 'Umgebung\Schnittstelle\IN'

Schnittstelle
IN
FREIGABE
BILD_NR1
BILD_NR2
DB_HAND_PLUS1
DB_HAND_MINUS1
DB_HAND_PLUS2
DB_HAND_MINUS2

Name	Datentyp	Adresse	Anfangswer	Ausschlussop	Abbruchop	Kommentar
FREIGABE	Bool	0.0	FALSE	☐	☐	freigabeschalter fuer den baustein 1=true=aktion
BILD_NR1	Word	2.0	W#16#102	☐	☐	fixe kennung des einrichtebild 1
BILD_NR2	Word	4.0	W#16#202	☐	☐	fixe kennung des einrichtebild 2
DB_HAND_PLUS1	Block_DB	6.0		☐	☐	db mit kettennr. fuer plus bewegungen fuer ebild1
DB_HAND_MINUS1	Block_DB	8.0		☐	☐	db mit kettennr. fuer minus bewegungen fuer ebild1
DB_HAND_PLUS2	Block_DB	10.0		☐	☐	db mit kettennr. fuer plus bewegungen fuer ebild2
DB_HAND_MINUS2	Block_DB	12.0		☐	☐	db mit kettennr. fuer minus bewegungen fuer ebild2
				☐	☐	

Fig. 143: "FB_EXECUTABLE" IN parameter

Fig. 144: "FB_EXECUTABLE" OUT parameter

Description

Function block to update the executability in the HMI setup screen.

If the HMI setup screen is selected, the entire area of the motion flags is cleared once in the first selection cycle. This area is also completely cleared after the deselection of the HMI setup screen. If enable of "FB_EXECUTABLE" is removed, the area of the motion flags is cleared, irrespective of whether the HMI setup screen is active. Only when the motion is present constantly for more than one second in the "DB_HMI", does the block function of the step selection become active.

Depending on the selected motion screen, the SEQUENCEDBNUMBER and the STEPNUMBER are read out in "DB_MAN_PLUS_1" ("-2") for motion in the plus direction and in "DB_MAN_MINUS_1" ("-2") for motion in the minus direction (see Structure of "DB_MAN_PLUS_1", "DB_MAN_MINUS_1", "DB_MAN_PLUS_2", "DB_MAN_MINUS_2").

Note	The FB checks whether the sequence DB is from S7 GRAPH, and has been created with at least V4.0 of S7 GRAPH. Only as of V4.0 is it possible to parameterize a permanent processing of all interlock conditions.

The update is only performed for 16 motions of this group, not for all 256 motions! This would be too intensive during runtime!

Requirements for calling "FB_EXECUTABLE"

"FB_EXECUTABLE" must only be called absolutely because an initialization of the instance data block data is not performed when the FB is called conditionally. The FB can be switched on and off via the "Enable" input. The correct procedure for an enable would be:

1. Switch sequence to manual mode.
2. With the manual mode, activate the permanent processing of the interlocks of All steps of all sequences. This can be set via Tools -> Block or application settings (permanent processing of all interlocks in manual mode.
3. Set enable for "FB_EXECUTABLE".

The shutdown is performed in reverse order.

Data interface

The update is only performed for maximum 16 motions of a setup screen whose start motion number is in the "DB_HMI".LineIndex_PageStart (DBW2914), and whose end motion number is in the "DB_HMI".LineIndex_PageEnd (DBW2916).

Data used:

HMI PRO DB	Indirectly	addressed via "MMC.DB_HMI_PRO" (DB19.DBW128)
"DB_HMI".screen_No (DBW84)	Read access	Currently active screen number. The block polls the screen ID and only becomes active when the ID of parameter "BILD_NR1" or "BILD_NR2" is identical to "DB_HMI".screen_No.
"DB_HMI".LineIndex_PageStart (DBW2914)	Read access	Instance DB or as multi-instance in FB_HMI_ENERGY_CONSMPT
"DB_HMI".LineIndex_PageEnd (DBW2916)	Read access	End motion number dual 101–356/401-556 for motion 1-256 Maximum number of 16 motions between start and end
"DB_HMI".motion_1_executable_l DBX 198.0 to to **"DB_HMI".motion_256_executable_r DBX 261.7**	Write	Motion flags for 256 motions in the plus direction and minus direction.

Called subprograms:

SFC 64 "TIME_TICK" to read out the system time

SFC 21 "FILL" to fill memory areas.

Parameter description

Note	The "HMI PRO" data block is read from "MMC.DB_HMI_PRO" DB19.DBW128.

Parameter	Data type	Description
ENABLE	BOOL	Executability is only determined after the enabling. The following applies to parameter Enable: The enable must be declared in the first cycle after the restart as "FALSE", it must only be set to "TRUE" in the second cycle.
BILD_NR1	WORD	Screen ID of setup screen 1 (normally W#16#40)
BILD_NR2	WORD	Screen ID of setup screen 2 (normally W#16#41), if not used, enter number of screen that could not be obtained!
DB_HAND_PLUS1	BLOCK_DB	DB with sequence number for plus motions for setup screen 1

DB_HAND_MINUS1	BLOCK_DB	DB with sequence number for minus motions for setup screen 1
DB_HAND_PLUS2	BLOCK_DB	DB with sequence number for plus motions for setup screen 2
DB_HAND_MINUS2	BLOCK_DB	DB with sequence number for minus motions for setup screen 2
ERROR	WORD	Status and error messages 0000 0 Block does not run 0001 1 Setup screen is selected 0011 3 Wait time (1 s) is elapsing 0101 5 Pointers are being calculated 1001 9 Update is taking place 8001 No motion has been selected in DB59.DBW2914 or DB59.DBW2916 The values are invalid □ no update!

Table 47: FB_EXECUTABLE – Parameter description

The following applies for the runtime of "FB_EXECUTABLE":
"FB_EXECUTABLE" must only be called absolutely because an initialization of the instance DB data does not take place when the FB is called conditionally.
The FB can be switched on and off via the enable input.

6.6.2.3 "FB_DIAG_EXECUTABLE" FB450 (V1.7)

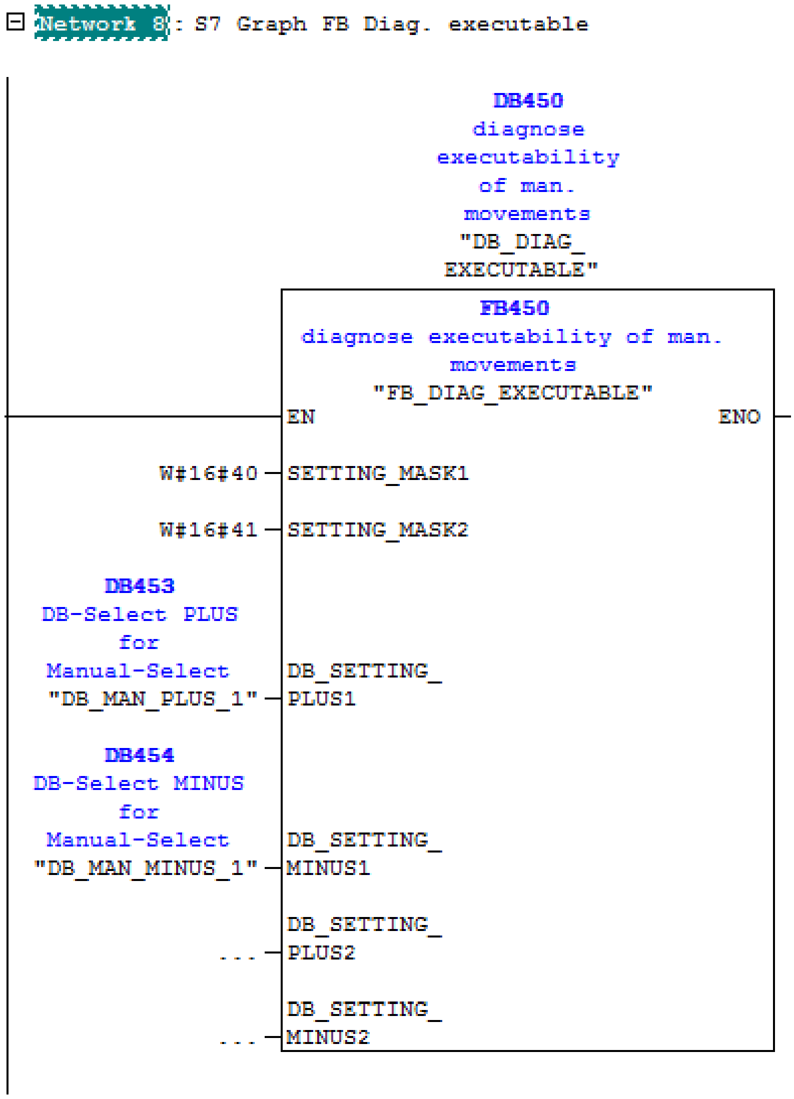
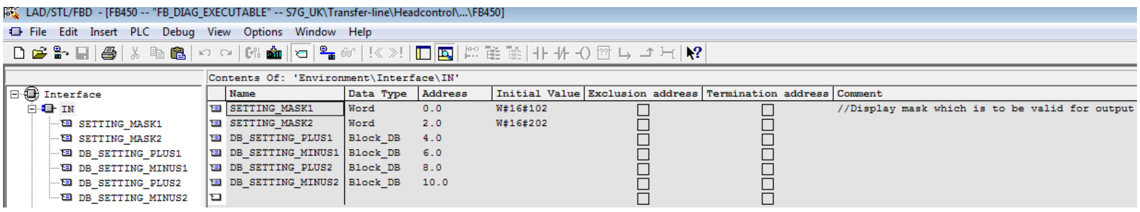


Fig. 145: "FB_DIAG_EXECUTABLE" FB450



Name	Data Type	Address	Initial Value	Exclusion address	Termination address	Comment
SETTING_MASK1	Word	0.0	W#16#102	☐	☐	//Display mask which is to be valid for output
SETTING_MASK2	Word	2.0	W#16#202	☐	☐	
DB_SETTING_PLUS1	Block_DB	4.0		☐	☐	
DB_SETTING_MINUS1	Block_DB	6.0		☐	☐	
DB_SETTING_PLUS2	Block_DB	8.0		☐	☐	
DB_SETTING_MINUS2	Block_DB	10.0		☐	☐	
				☐	☐	

Fig. 146: "FB_DIAG_EXECUTABLE" IN parameter

Description

Function block for the update of the call interface for the HMI PRO process diagnostics for the detail diagnostics.

Each triggering of a setup function is recorded with S7 GRAPH. The SEQUENCEDBNUMBER and STEPNUMBER stored in the blocks "DB_MAN_PLUS_1" ("-2") for motion in the plus direction and "DB_MAN_MINUS_1" ("-2") for motion in the minus direction are stored in the instance DB of the FB from data word 14.

Requirements for calling the "FB_DIAG_EXECUTABLE"

The "FB_DIAG_EXECUTABLE" must only be called absolutely because an initialization of the instance data block data is not performed when the FB is called conditionally.

Data interface

The update is only performed for the motion triggered by pressing one of Direct keys in the enabled screen.

<u>Data used:</u>

HMI PRO DB	Indirectly	addressed via "MMC.DB_HMI_PRO" (DB19.DBW128)
"DB_HMI".screen_No (DBW84)	Read access	Currently active screen number. The block polls the screen ID and only becomes active when the ID of parameter "BILD_NR1" or "BILD_NR2" is identical to "DB_HMI".screen_No.
"DB_HMI".P_plus or "DB_HMI".P_minus and "DB_HMI".motion_plus or "DB_HMI".motion_minus with "1"		

Parameter description

Note	The "HMI PRO" data block is read from "MMC.DB_HMI_PRO" DB19.DBW128.

Parameter	Data type	Description
BILD_NR1	WORD	Screen ID of setup screen 1 (normally W#16#40)
BILD_NR2	WORD	Screen ID of setup screen 2 (normally W#16#41), if not used, enter number of screen that could not be obtained!
DB_HAND_PLUS1	BLOCK_DB	DB with sequence number for plus motions for setup screen 1
DB_HAND_MINUS1	BLOCK_DB	DB with sequence number for minus motions for setup screen 1
DB_HAND_PLUS2	BLOCK_DB	DB with sequence number for plus motions for setup screen 2
DB_HAND_MINUS2	BLOCK_DB	DB with sequence number for minus motions for setup screen 2

Table 48: FB_DIAG_EXECUTABLE – Parameter description

6.6.3 HMI PRO process diagnostics

With the standard diagnostics, faults that occur on a machine can be identified quickly and in detail.

Three diagnostics screens are available in HMI PRO on the operator panel:

Alarms/messages

All the fault and system status messages are available on the Alarms/Messages screen.

Diagnostics unit (overview screen)

The units screen displays the diagnostics-capable units in the plant.

Diagnostics detail

The results of the criteria analysis are displayed in the detail screen. The cause of the fault is analyzed.

Note	These screens must be integrated in an HMI PRO project!

6.6.3.1 System requirement

The following system requirements apply for the use of the HMI PRO process diagnostics:

- HMI PRO RT >= Version 7.3.0.9
  HMI PRO RT must be installed on the target system.
- HMI PRO CS >= Version 7.3.0.9
  HMI PRO CS must be installed on the same configuration PC that has the SIMATIC project to be diagnosed.
- Graph groups and state graphs must be available in the S7 GRAPH memory format >= V5.1.
- The PLC used must support the SFC17 or SFC18.

6.6.3.2 Generating diagnostics data

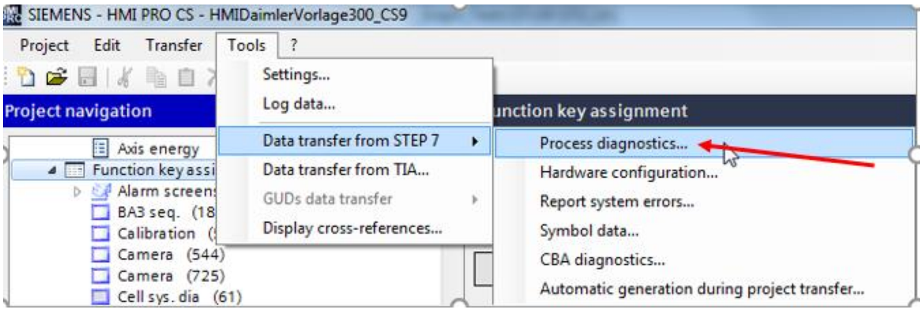


Fig. 147: Selecting the diagnostic data generation

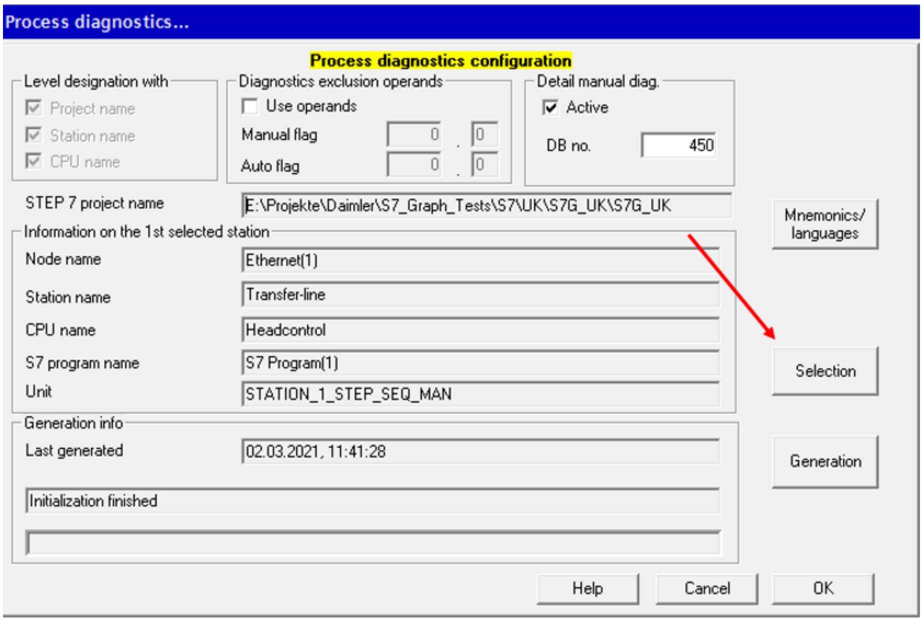


Fig. 148: Generating diagnostics data

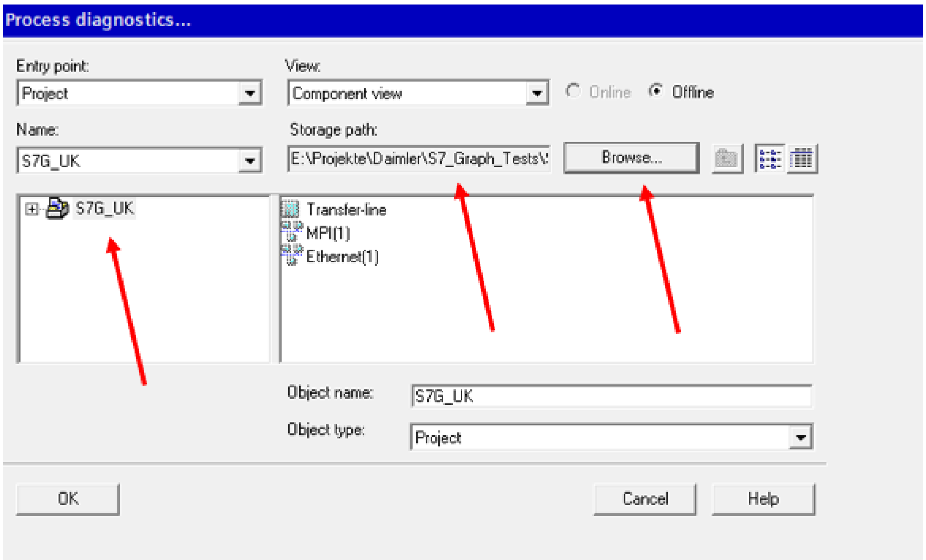


Fig. 149: Selecting the STEP 7 project

After this selection, it is possible to select one of the CPUs available in the project.

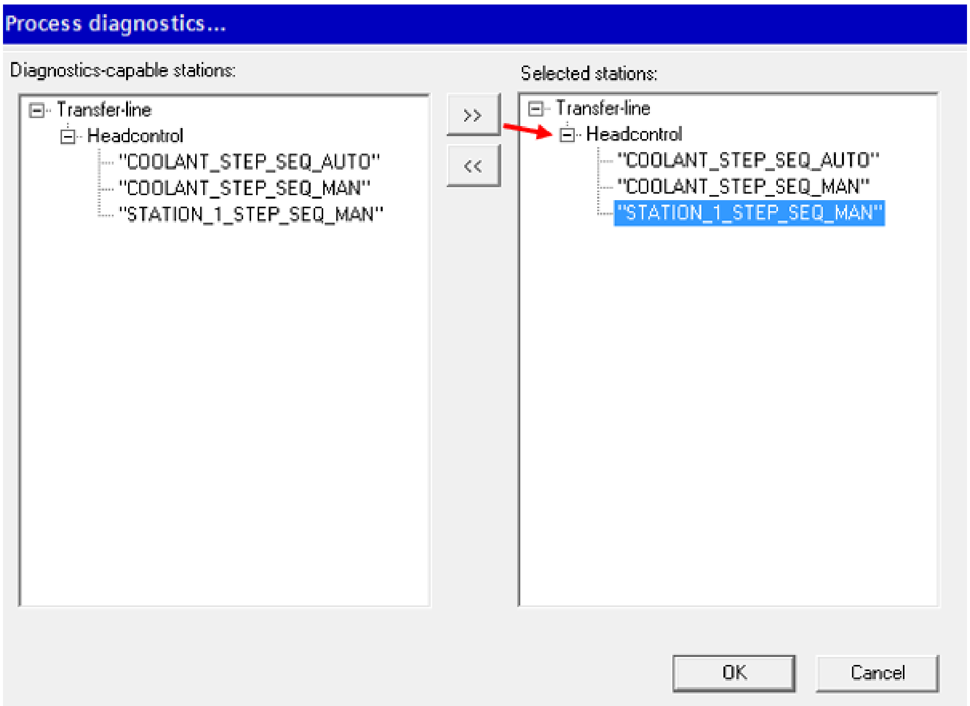


Fig. 150: Selecting diagnostics-capable units

All the diagnostics-capable units are displayed in the left-hand window. Only after they have been transferred to the right-hand window, can these units also be transferred to the OP for display. After completing the selection, the texts for the diagnostics are generated.

Note	If adaptations have been made in the diagnostics-capable units, the diagnostics data must be regenerated.

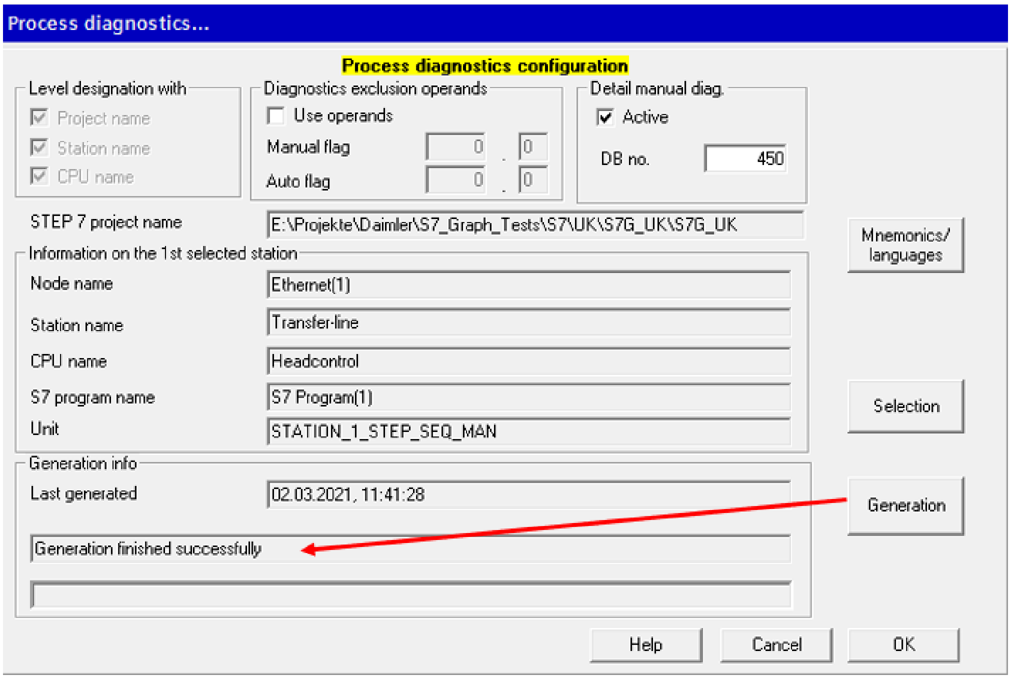


Fig. 151: Generating the diagnostic data

The HMI PRO project can then be transferred to the operator panel with the newly generated diagnostic data.

6.6.3.3 S7 GRAPH memory requirement

Based on the following estimation, you can see approximately how much memory space is required by the S7 GRAPH FB and instance DB in the working memory.

→ (n = number of steps):

FB = 4900 bytes + n x 130 bytes

DB = 270 bytes + n x 70 bytes

The following supplementary conditions apply (for typical step sequences):

1. The option "Compile with criteria analysis" in the "Compilation" tab cannot be selected.
2. On average, each step contains 1.2 transitions, 1.5 actions and 0.8 time monitoring actions.
3. On average, each transition contains 3.5 conditions.

If, for each transition, interlock or supervision, significantly more conditions have been programmed, this can significantly increase the memory requirement. Per condition and action, 12 bytes are required.

6.6.4 Diagnostics of the manual step sequences

6.6.4.1 Requirements

The specifications in Chapter 2 must be observed and the TRANSLINE blocks in Chapter 3 must be programmed in the STEP 7 project according to the software structure in the "Software Guide, General" document.

6.6.4.2 Structure of the manual step sequences

Interlock error

The conditions required to execute the manual functions in the setup screens should be programmed in the interlock network. If the interlock has a "1" state, it is indicated in the setup screens via the executability display.

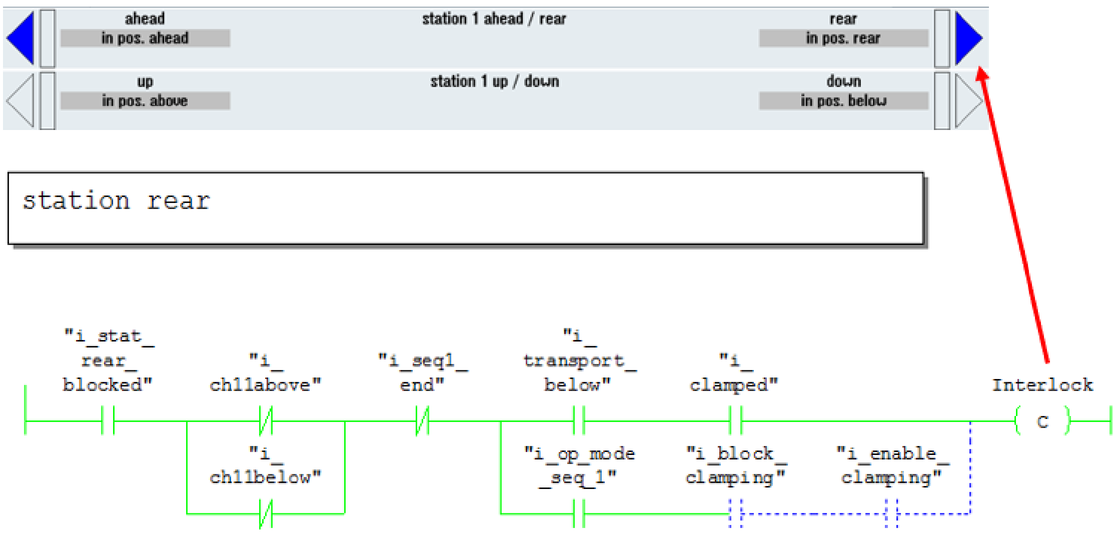


Fig. 152: Executability display

Monitoring error

Since there is no advance to the next step in a manual sequence even when the condition is fulfilled, the configured step monitoring time is exceeded through the longer actuation of the setup function selection and a monitoring error is generated. In order that this state does not occur, the S7 GRAPH-specific operand xxxx.TT is programmed in the monitoring network of the step.

xxxx.TT = transition fulfilled

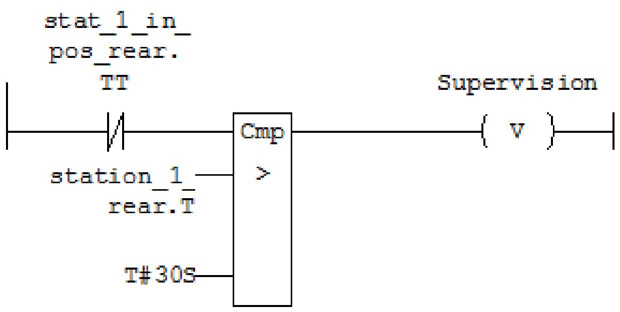


Fig. 153: Monitoring network

Activating the detail manual diagnostics

The detail manual diagnostics must be activated during the generation of the process diagnostics data and entered in a diagnostics block. (Standard block: DB450).

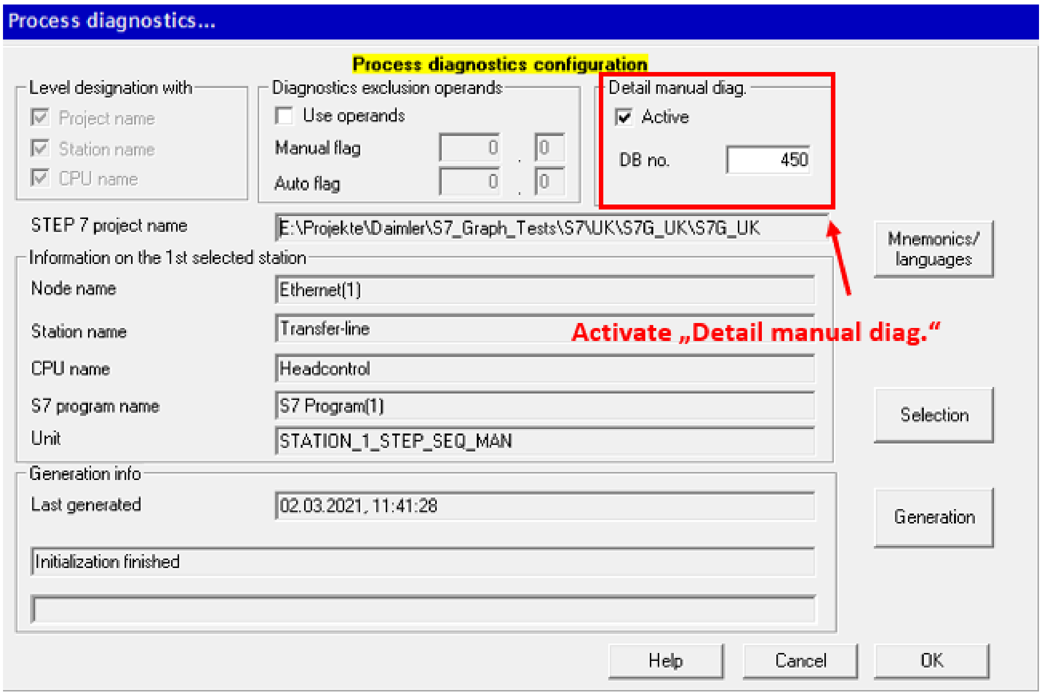


Fig. 154: Detail manual diagnostics

Function description of the detail manual diagnostics

The function block FB450 with the DB450 updates the call interface for the HMI PRO process diagnostics for the detail diagnostics.

(see Chapter 6.6.2.3)

In this way, the missing step enabling condition or the missing interlock condition can be determined via the "Detail Diagnostics" screen.

There are two ways to do this.

1. Possibility:
   Switch directly from the direct key screens to the Detail Diagnostics screen with the "Next Windows" key:

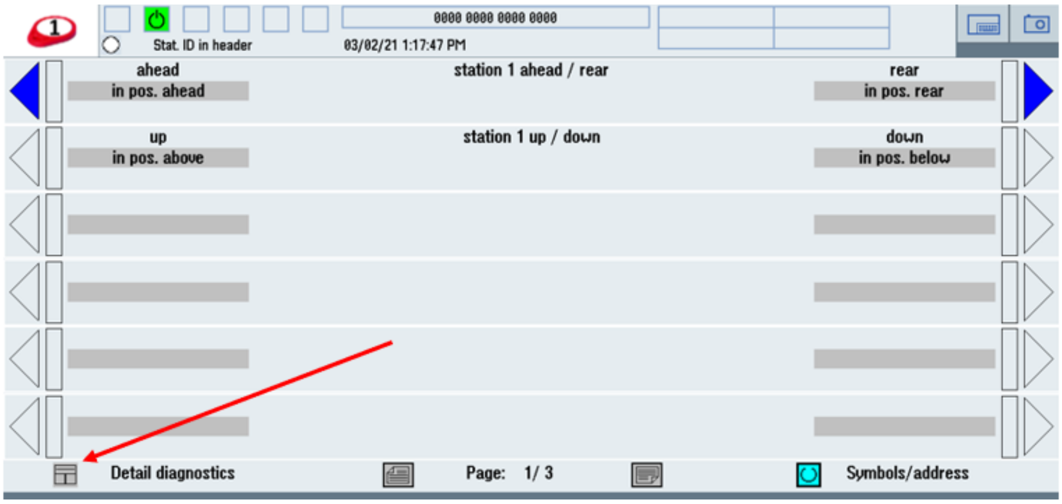


Fig. 155: Manual diagnostics direct key screen

2. Possibility:
   Switch to the Detail Diagnostics screen after selecting a diagnostics-capable error message in the Alarm History screen:

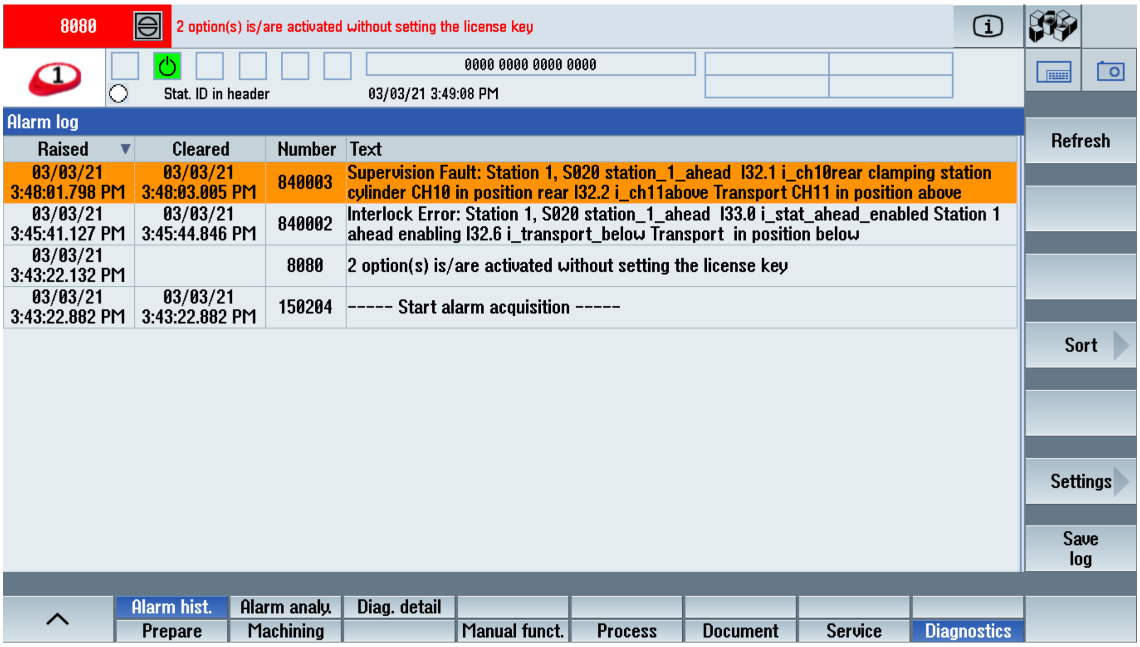


Fig. 156: Manual diagnostics alarm history screen

Display of the missing step enabling condition in the Detail Diagnostics screen:

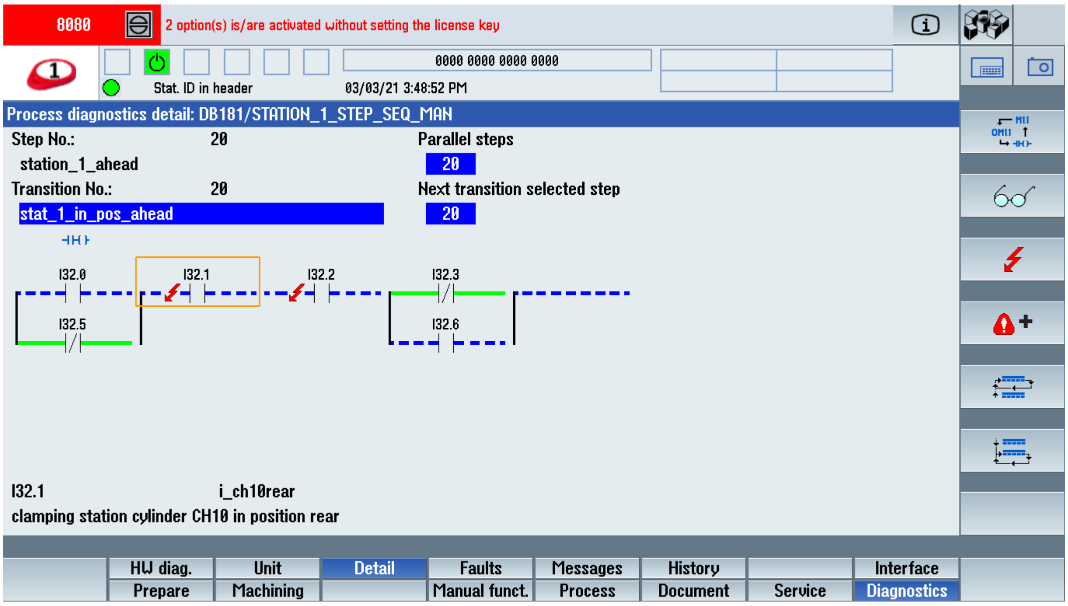


Fig. 157: Detail Diagnostics screen

Status display of larger S7 GRAPH step sequences

If visualization problems occur in the status display of larger S7 GRAPH step sequences, the number of status jobs to be used for the display can be changed.

Note	If you select this option, only the specified number of status jobs are used for the monitoring. In this way, you do not have to use all the system resources for the S7 GRAPH status functions and can operate other status functions in parallel (e.g. variable status). The standard number is "2", the maximum number is "5".

7 HMI configuration

7.1 HMI Pro

7.1.1 Direct key screens

The following screens are associated with the direct key screens:

Setup screen

The machine unit can be controlled manually in the Setup function mode using **Setup screen1** or **Setup screen2**. Several screens, type **Setup screen1** or **Setup screen2** can be integrated in HMI PRO. Each setup screen can manage 256 setup movements; a maximum of 6 movements can be displayed on each screen page. For special functions it is possible to display individual setup lines in the **Variables Layout** screen.

Power-up conditions

These are conditions that must be met in order to run the entire machine in automatic mode. Up to 48 switch-on conditions are displayed (maximum of 6 per page).

Cycle types

The various cycle types of the plant are activated and deactivated in this screen (e.g. single cycle, warm runs (traversing without part), no-load traversing of machine etc.). Up to 16 cycle types are displayed (max. 6 per page).

Nut runner selection/deselection

For assembly lines, the screen permits individual nut runners to be selected and deselected using the

direct key functions on the operator panel. The following

functions are provided: Up to 80 nut runner spindles (maximum of 6 per screen) are displayed in 2 areas.

Group selection/deselection

For assembly lines, this screen permits nut runner groups to be selected and

deselected. Up to 40 nut runner groups are displayed (maximum of 6 per page).

7.1.2 General information

Prerequisite for the use of the direct key screens, is that the direct keys are connected to the PLC. This can be achieved in a number of ways.

Using the MPP

If an OP015 black or IPC4x7 is used, the direct keys must be simulated via HMI PRO sl.

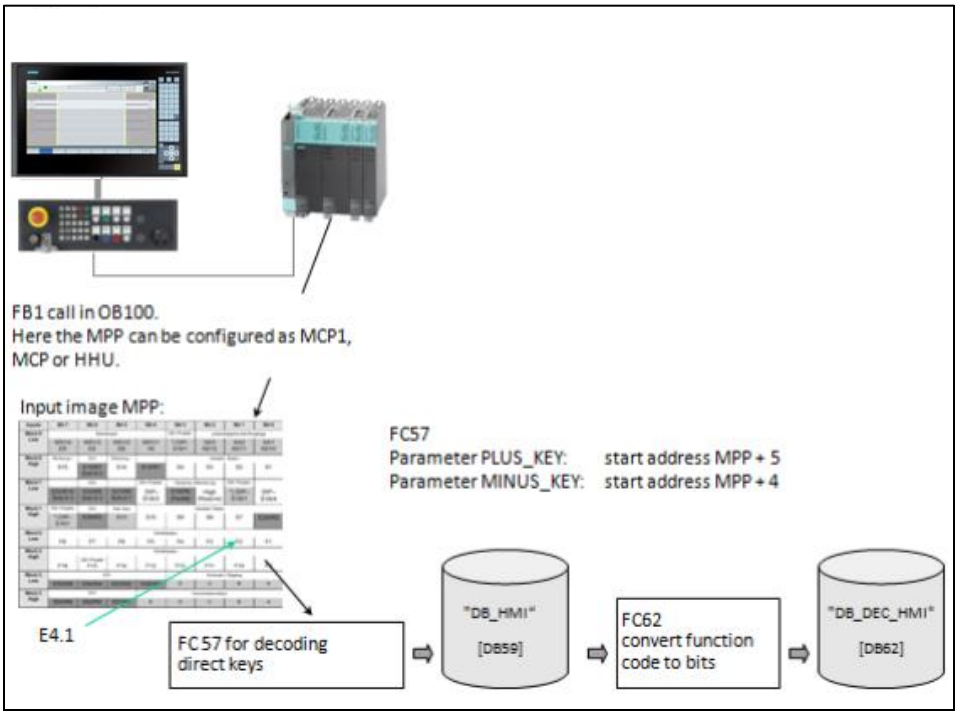


Fig. 158: Direct keys: OP015 black via simulation in the HMI Pro CS

Using the HT8

The direct keys must be disabled for this device.

When used, attention must be paid to the modified key arrangement in the PLC.

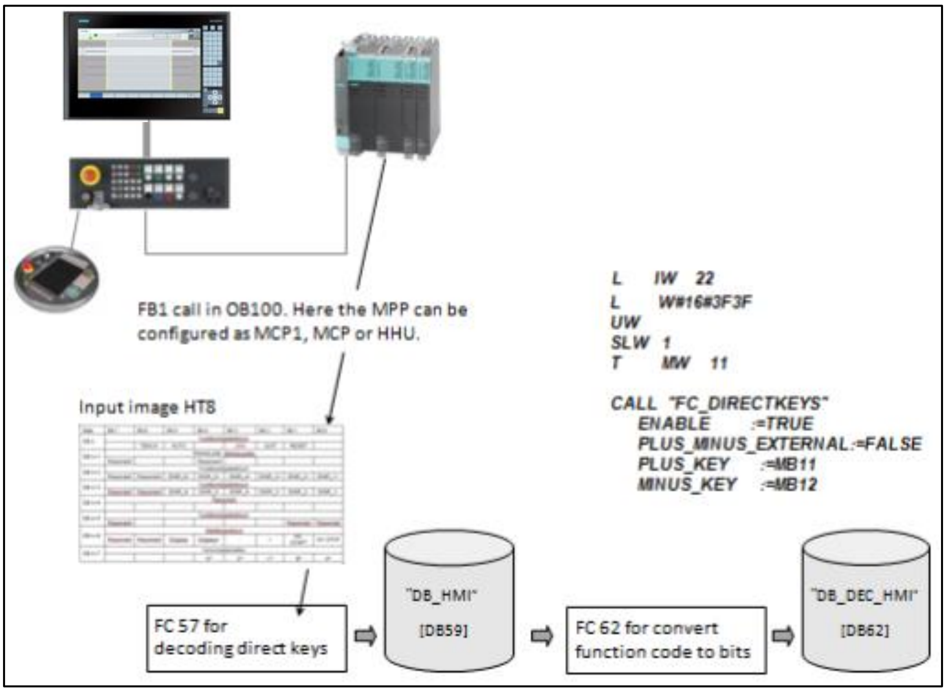


Fig. 159: Direct keys: Using the HT8

Using the TCU + OP015 black

The direct keys of the TCU must be enabled for these devices.

When used, attention must be paid to the modified key arrangement in the PLC.

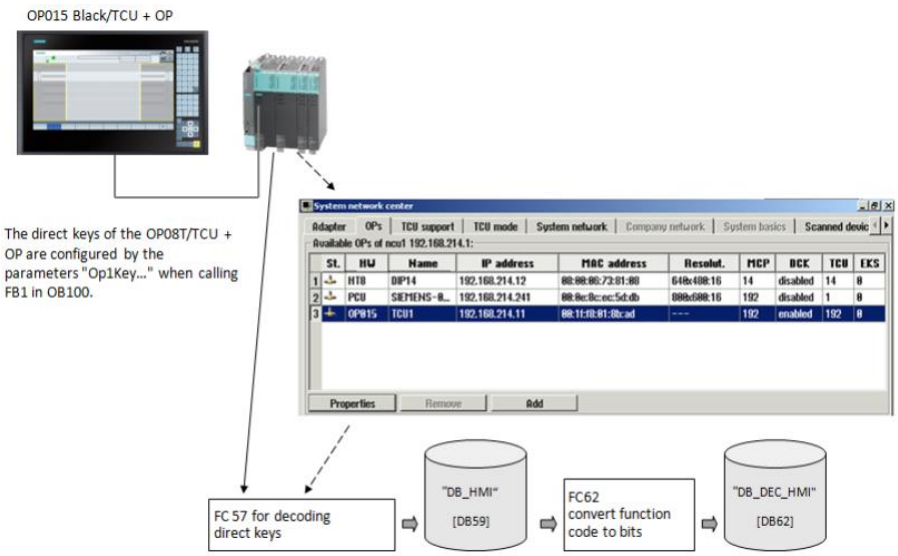


Fig. 160: Direct keys: Using the TCU + OP

Second control station in assembly with S7-300 OP015 black TCU

If a second control station is required in the assembly plant, this must be implemented with an OP015 black (second control station) in combination with the first control station.

7.1.3 Configuration of direct key screens

The configuration and sequence are displayed by means of a setup function (setup screen 1).

Inserting a setup screen in the function key assignment:

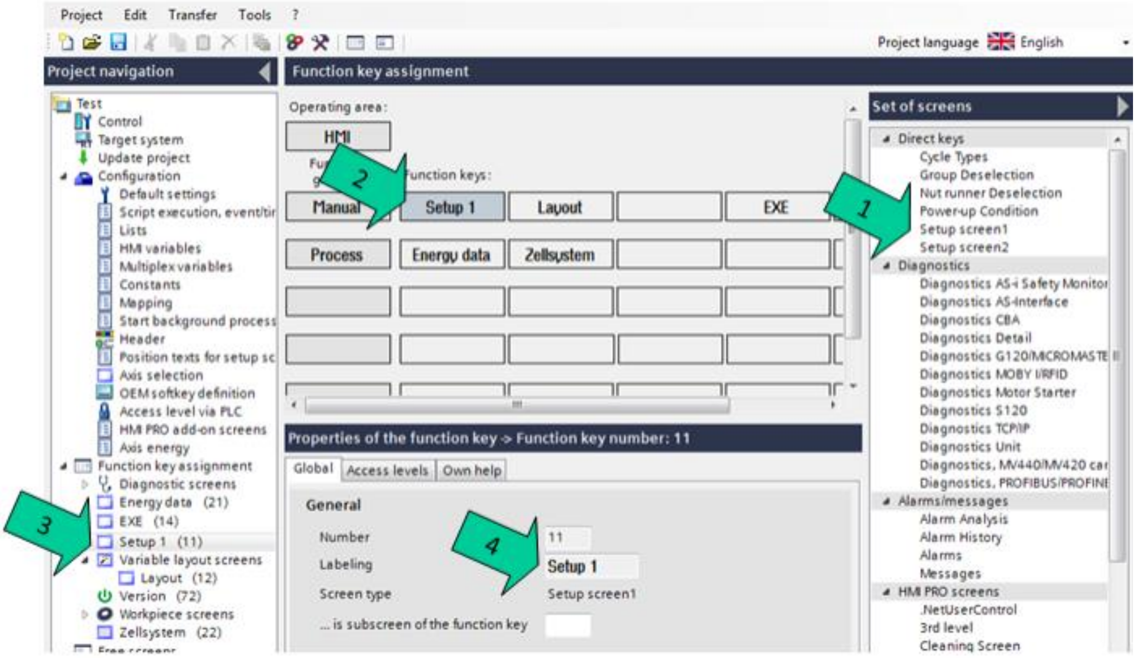


Fig. 161: Configuration of setup functions in the function key assignment:

This is done with HMI PRO CS in the menu item in the Function

keys assignment window. In the Screens window, select the setup screen from the Direct keys list (Fig. 161 → 1) and drag and drop it into the function keys assignment (Fig. 161 → 2). The screen is displayed there with its standard softkey designation. Change the softkey labeling as required (Fig. 161 → 4). The properties of the function key onto which you have pasted the image can be configured in the Properties of the function key window under the tabs Global, Access levels, and Own help.

The configured screen is also displayed in the Project navigation window below the function key assignment node (Fig. 161 → 3).

Configuration in the setup screen editor

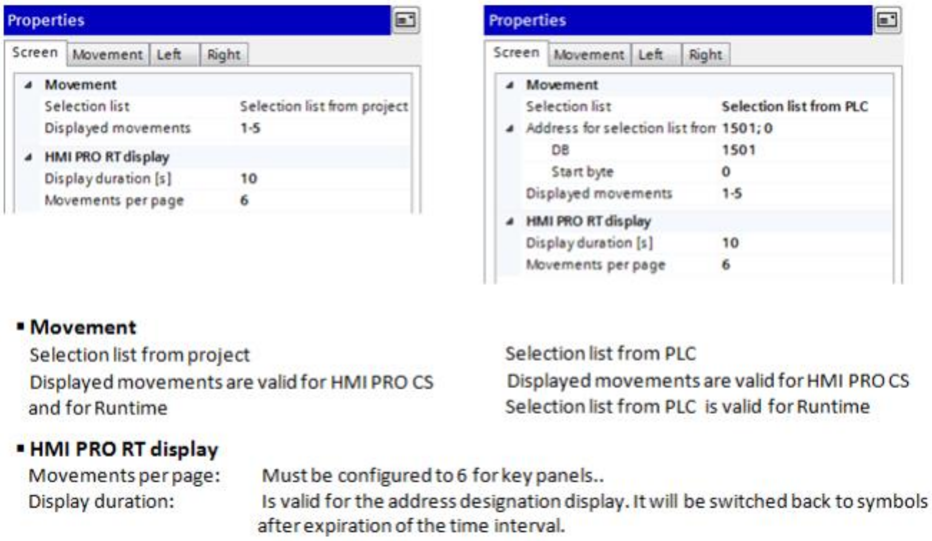


Fig. 162: Configuration of setup functions in the setup screen

Specify the numbers of the movements that are to be displayed in this screen in the Properties window in the Screen tab under Displayed movements (Fig. 162) These movement numbers must be unique for each setup screen.

Double-clicking on the softkey in the function keys assignment takes you to the configuration of the direct keys screens. Specify the texts, colors and functions of the screen here. The position indicator can also be configured for the setup screens.

Note	An address and symbolic name must be stored for each movement. The **address name must be coordinated with the technical department**.

General properties such as name of the movement, symbolic designation and position are entered under Properties ▶Movement. Setup functions of additional properties regarding movement selection can be assigned via Select single movement. These features are available from HMI PRO CS Version ≥ 8.1.

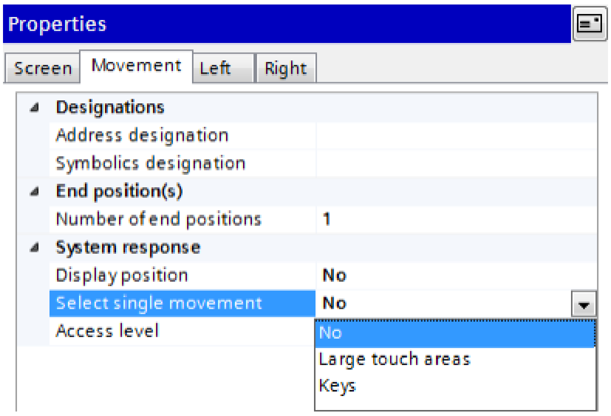


Fig. 163: Configuring setup screens in HMI PRO CS: Movement properties

- Select single movement: Large touch areas

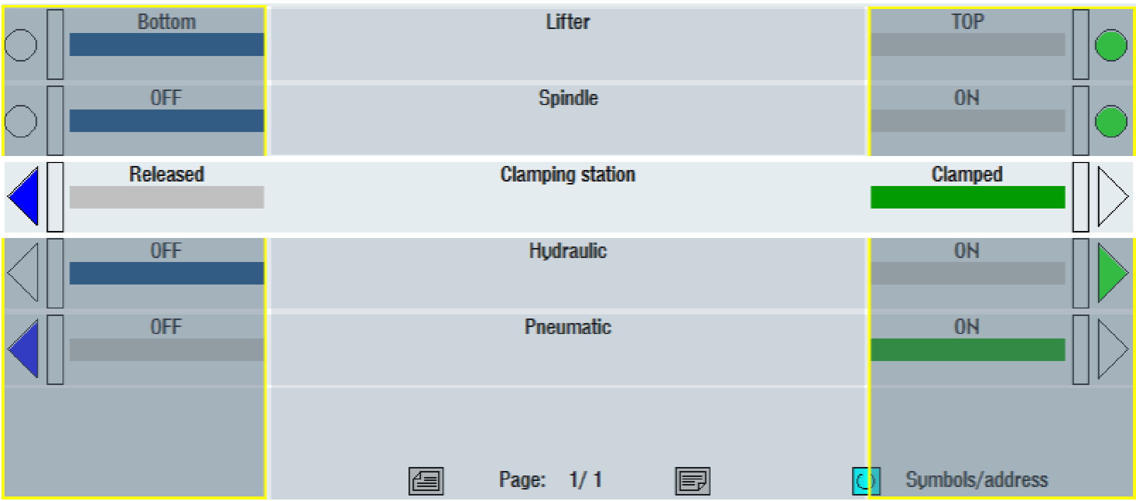


Fig. 164: Large touch areas: Display in HMI PRO RT

In manufacturing and where an OP015 black is used, the setting Large Buttons must be used.

- Select single movement: Keys
  Using the Keys configuration, a higher degree of reliability can be achieved that movement is actually initiated using hardware keys.

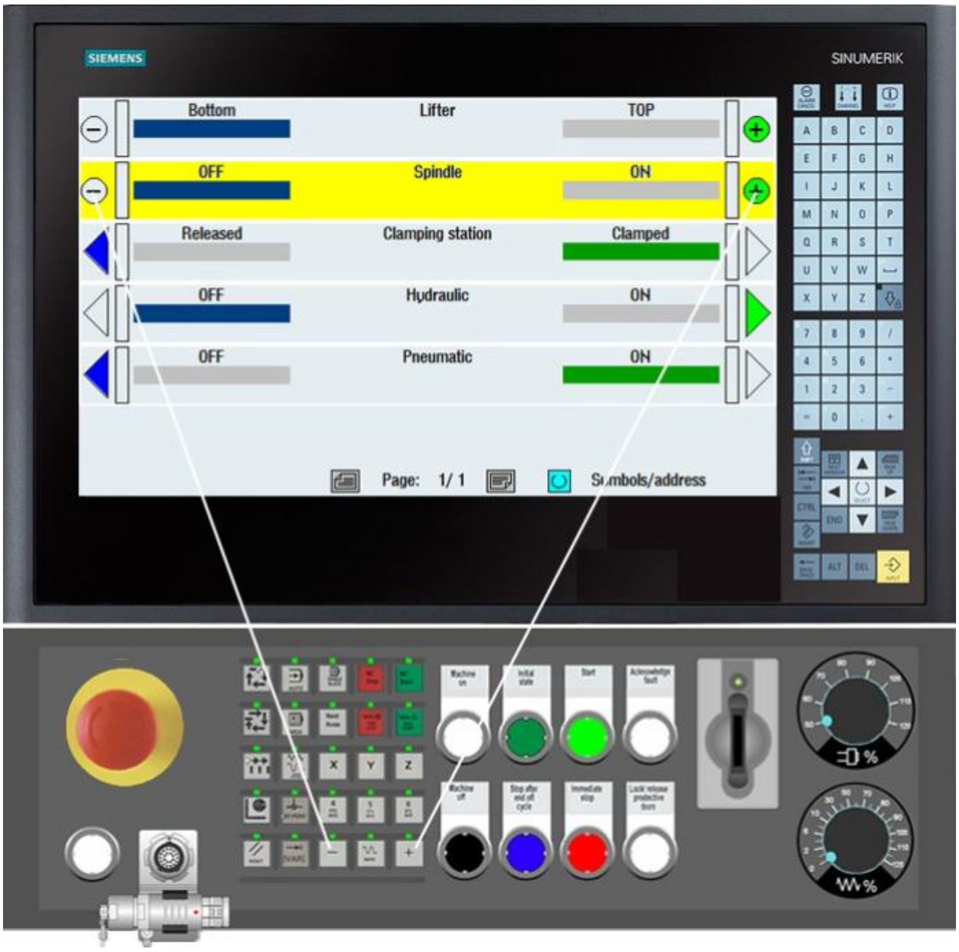


Fig. 165: Keys: Display in HMI PRO RT

In assembly, the preference is the setting **Keys**.

Under**Properties**▶**Left** or ***Right***, the properties for the active movement and end positions are defined.

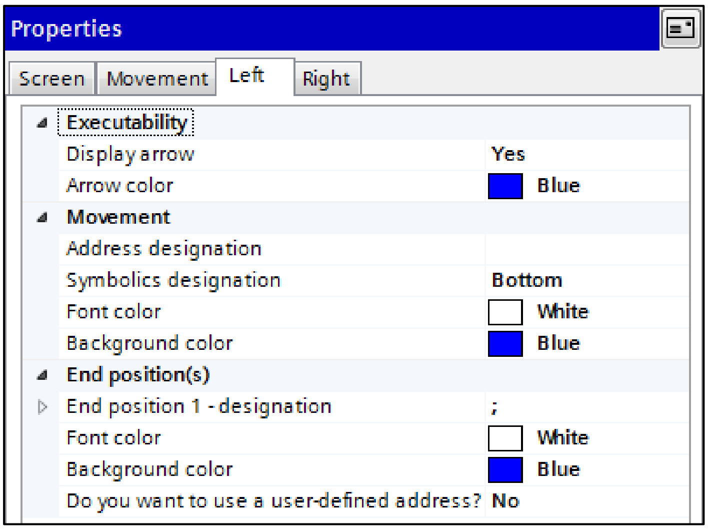


Fig. 166: Configuring setup screens in HMI PRO CS: Properties, left

Triggering a setup function

If one of the vertical direct keys is pressed, or the touch surface for touch operator devices,

this is signaled to HMI PRO and in the controller using the direct key function of the operator panels, a bit is activated. In the control, the FC_DIRECTKEYS (FC57) compares the signals of the HMI PRO Standard data block DB_HMI with the direct keys signals. If this comparison is successful within the time which is set as monitoring time in HMI PRO CS under Project navigation ► Configuration ► Default settings ► Operator panel, the following information is set for the movement: The direction bit DB_HMI.P_plus for movement towards the initial setting (+) and DB_HMI.P_minus for movement in the opposite direction. The function code (BCD code of the setup movement) of the pressed key is written to DB_HMI.function_no_low (DBB79) and DB_HMI.function_no_high (DBB80). The FC_DEC_HMI (FC62) function decodes the function code into a bit in DB_DEC_HMI (DB62).

7.1.4 Functional sequence for direct key screens

The supply of the direct key screens is described using the setup screen. A solution using LAD/ FBD is described in the following section of the block description. This solution can be used for the Cycle type, Power-on conditions, Nut runner selection/deselection and Group selection/deselection screens.

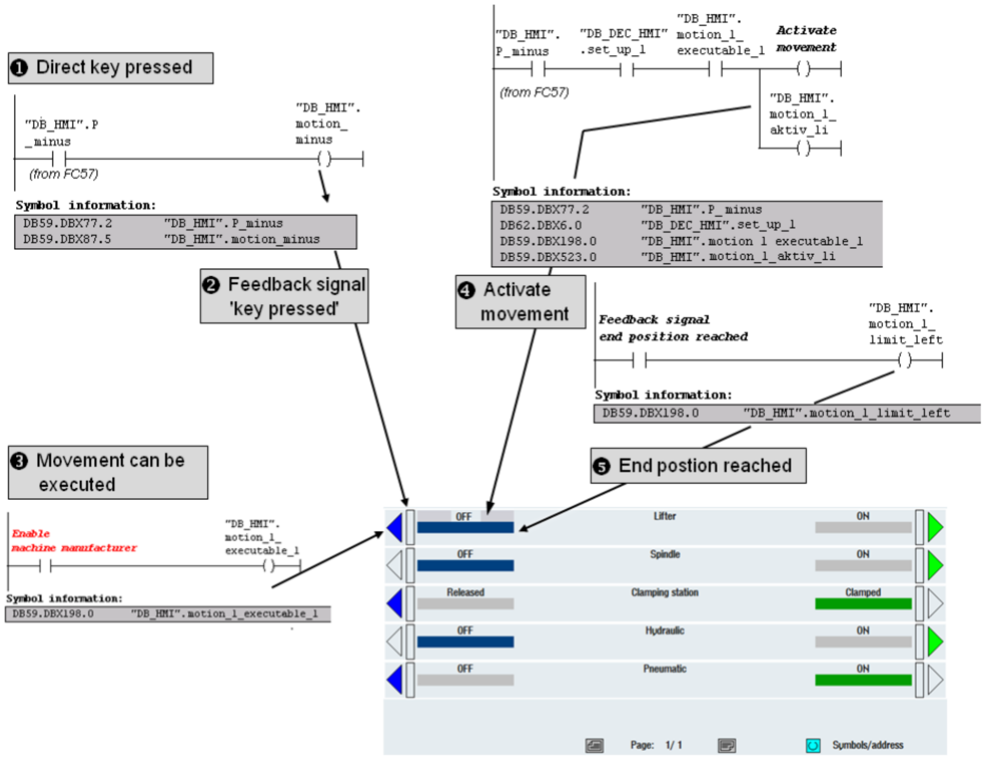


Fig. 167: Supply of the direct key screens (example for the 1st direct key left '-')

Information on key operation (Fig. 167)

When a direct key is pressed, bits DB_HMI.P_plus (DBX77.1) or

DB_HMI.P_minus (DBX77.2) are activated. The FC_DIRECTKEYS (FC57) maps these to the bits DB_HMI.motion_plus (DBX87.4) and DB_HMI.motion_minus (DBX87.5) (in the figure above: 1st direct key left, motion in direction '-'). The rectangle is highlighted in color to indicated 'Key pressed'.

Information on executability of the movement (Fig. 167)

The arrow symbol represents enabling of the execution of the movement. Enabling is performed by the machine manufacturer via the bit **DB_HMI.motion_X_executable_l** for movement to the left or **DB_HMI.motion_X_executable_r** for movement to the right [from DBX198.0]. The **Movement can be executed** display has to be updated in Setup mode.

X is the number of the movement (1-256)

Activate movement/Movement is being executed (Fig. 167)

The actual execution of the movement depends on:

- The movement bit **DB_HMI.P_plus** (DBX77.1) or **DB_HMI.P_minus** (DBX77.2)
- The bit **DB_DEC.setup[X]**, which controls the **FC_DEC_HMI** (FC62) in the **DB_DEC**,
- and the bit **DB_HMI.motion_X_executable_l** or **DB_HMI.motion_X_executable_r** (from DBX198.0).

These bits control the bit memory or output for the movement activation as well as the bit **DB_HMI.motion_X_active_left** or **DB_HMI.motion_X_active_right** [from DBX523.0]. If the movement is executed, this movement field is highlighted in color.

X is the number of the movement (1-256)

Information on end position reached (Fig. 167)

When the end position is reached, the user must set bit **DB_HMI.motion_X_limit_left** or **DB_HMI.motion_X_limit_right** (from DBX130.0). The field below the movement field is highlighted in color when the end position is reached.

X is the number of the movement (1-256)

7.1.5 Movement numbers in the setup screen

Note	When configuring, the movement numbers of movements or actions are displayed in HMI PRO CS. In HMI PRO RT, the movement numbers are only displayed for address-oriented display.

The appropriate screen from HMI PRO CS is illustrated below.

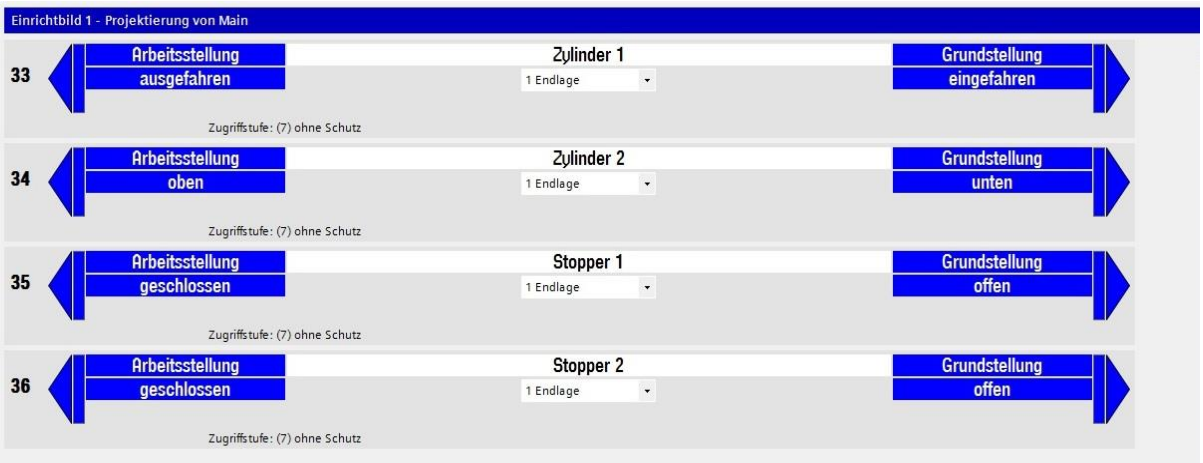


Fig. 168: Movements in the setup screen

7.1.6 Alternative end positions in the setup screen

Note	If there are several feedback signals, they must be programmed via the alternative end positions via DBs. Details are available in the HMI PRO CS help.

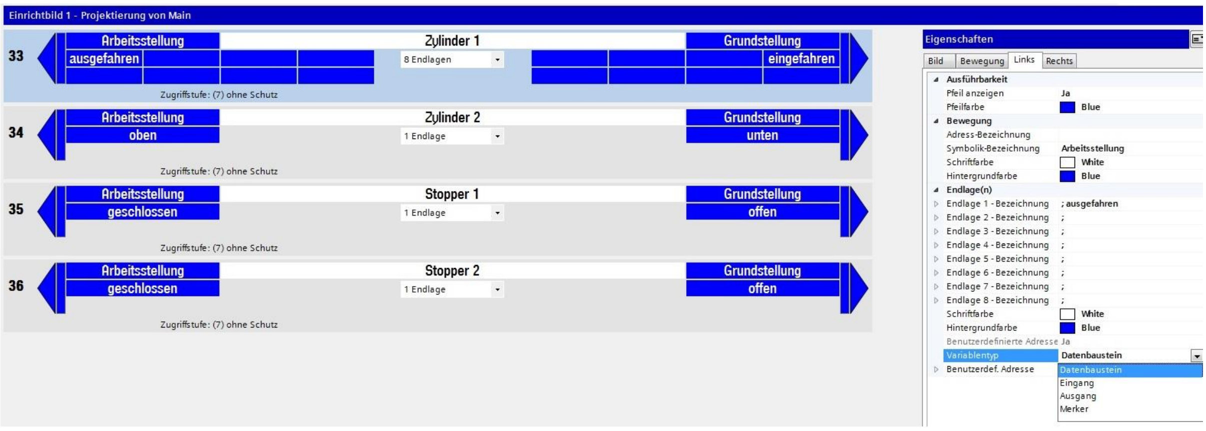


Fig. 169: Alternative end positions in the setup screen

7.1.7 "Mouse over" quick info on operator controls

Note	If further applications are called via HMI Operate, these applications must also provide tooltips or "mouse over" quick info at the operator control and display elements. A language changeover must also take effect here.

7.1.7.1 Integrating PDF documents in the HMI PRO interface

Note	If PDF documents are to be displayed in the HMI Pro interface, the help for the "Internet screen" must be observed when configuring in the HMI PRO CS.

7.1.7.2 Display of the active protection level in the HMI header

The active protection level must be visualized in the HMI header via the displaying of graphics. 8 images graphics are used to display the respective EKS key in the corresponding color. In addition, the protection level is displayed as text.

The template of the HMI text project of the project DVD must be used.

Note	Information on this is described in the HMI PRO CS help under Header/Screen layout.

7.1.7.3 Display of the requirements for the setup mode in the HMI header

The prerequisites for the setup mode must be visualized via the configuration of header texts in the HMI header. If the prerequisite is triggered but not yet achieved, the display should flash.

Note	Information on this can be found in the HMI PRO CS help under "Header".

7.1.8 Integrating an APEX control

Configuration in HMI PRO CS V8

Integrating the APEX control as EXE:

From the Set of screens window, HMI PRO screens group, add the Exe screen to the function key assignment of your HMI PRO text project. Double-click the function key to open the configuration dialog box:

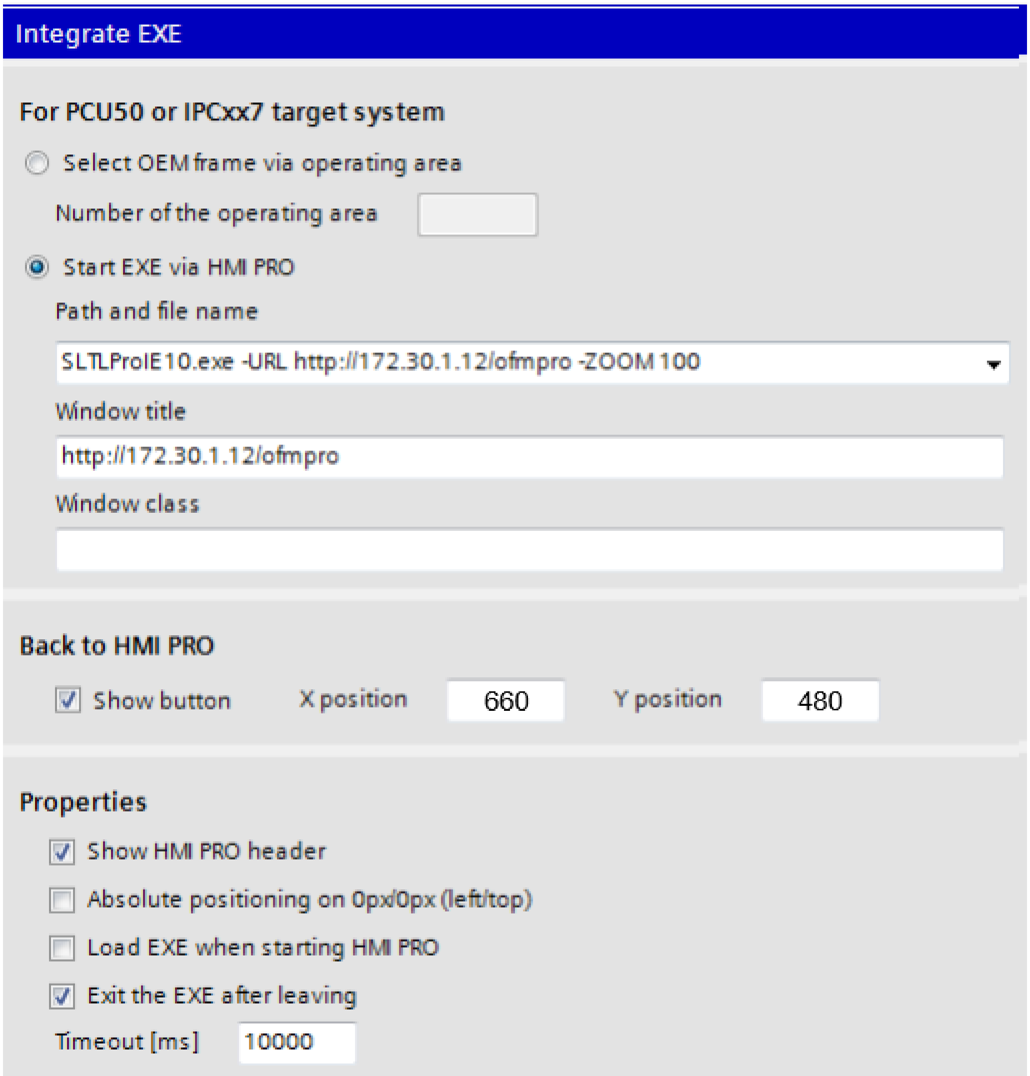


Fig. 170: Integrating EXE in HMI Pro V8

Start EXE via HMI PRO

Path and file name:

SLTLProIE10.exe -URL http://<IP address>/ofmpro -ZOOM <value>

<IP address>	IP address of the APEX control	
<value>	recommended settings for zoom (in %):	
	IPC	100

Window title:

http://<IP address>/ofmpro

<IP address> IP address of the APEX control

Back to HMI PRO

Select the Show button check box to display a pushbutton in your called application for the return to HMI PRO RT.

Only when using IPC: Specify the following positions so that the return pushbutton is positioned in the visible display area:

The button must be positioned bottom right

x-Pos	660
y-Pos	480

Properties

Timeout (ms): 10000

Auto-hide the Windows taskbar

Right-click **Start** and open the **Properties** dialog box. On the **Taskbar** tab, select **Auto-hide the taskbar.**

7.2 Diagnostic settings

7.2.1 Diagnostics in HMI Pro

7.2.1.1 PROFIBUS/PROFINET diagnostics

Display of functional sequence

The **PROFIBUS/PROFINET diagnostics** screen is used to diagnose the following hardware:

- PROFIBUS: DP master system → slaves
- Ethernet: PROFINET IO system → devices

The integrated drive bus (PROFIBUS Integrated) (PCI slot) cannot be diagnosed.

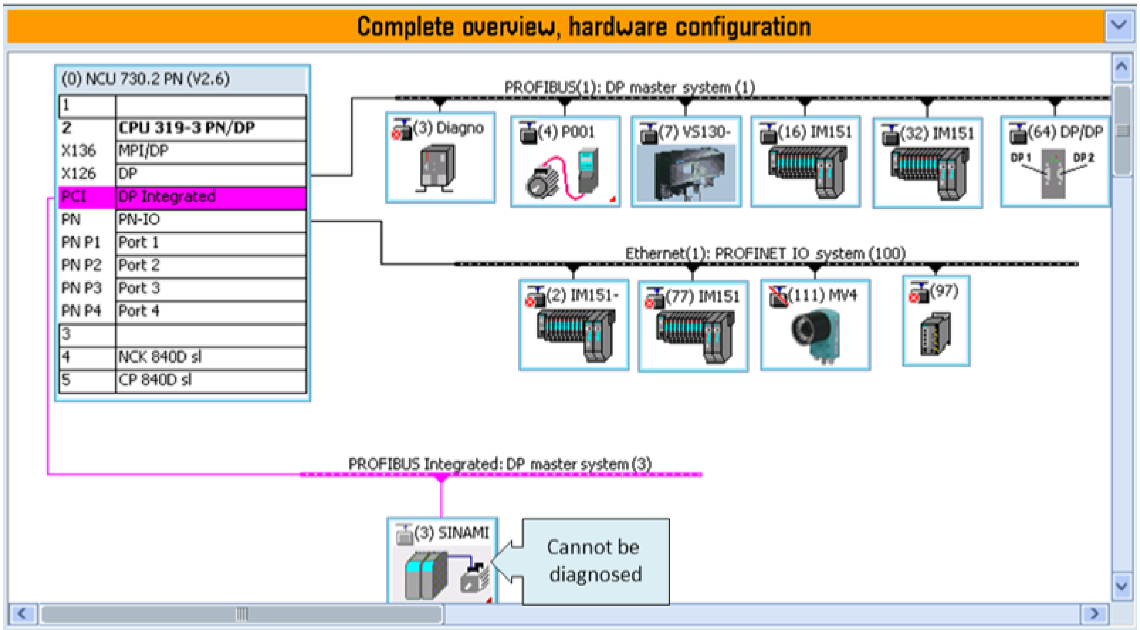


Fig. 171: PROFIBUS/PROFINET diagnostics overview

NOTICE	Profibus has not been released.

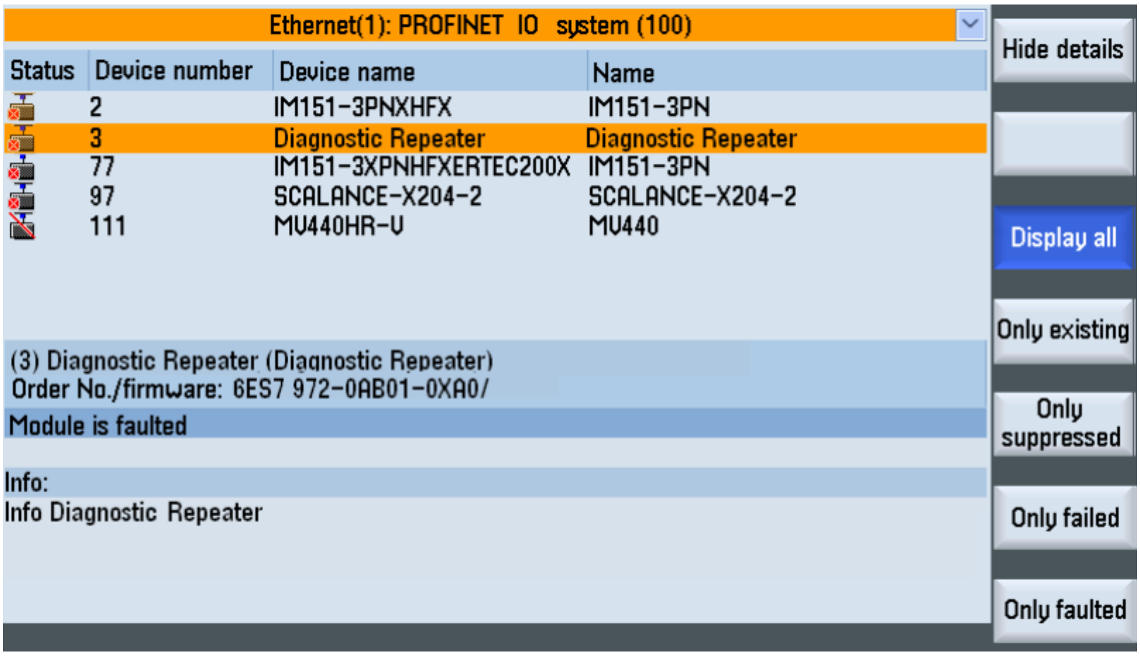


Fig. 172: PROFIBUS/PROFINET diagnostics, PROFINET details

Required blocks

PROFIBUS diagnostics on the operator panel is possible without blocks.

The **FB_SL_COM** (FB449) must be used for PROFINET diagnostics. This block supports HMI PRO sl for accesses to the PLC data. It must be active at all times. The enable is made using the **ACTIVE** parameter.

Alarm display

Information can be generated from several alarms, depending on the nesting depth.

These alarms are issued by HMI PRO, starting at number 900 000. Depending on the module, the alarms can contain the following information:

- Slave number
- Slave status
- Slave ID number
- Slave designation
- Error number
- Error type in text format
- Module number
- Module status in text format
- Channel number
- Channel type in text format
- Channel error code in text format
- Single channel diagnostics
- Alarm suppression

Suppressing blocks

Function block **FB_SL_COM** (FB449) supplies the instance DB with PROFINET data. The standard instance DB is **DB_SL_COM** (DB449).

General > Suppress: DB

Data block via which the **Module suppressed** status can be controlled individually for each module

General > Suppress: Byte

Start byte of the data block via which the **Module suppressed** status can be controlled individually for each module

The configured address for **Suppress** is evaluated consecutively bit-by-bit commencing from the start byte. Bit 0 controls the display for module 1, bit 1 controls the display for module 2,..., bit 50 controls the display for module 51, etc.

General > Activate alarms

Alarms and messages that are displayed in HMI PRO RT in the (MODULE)/PROFIBUS/PROFINET diagnostics details screen are also displayed in the header.

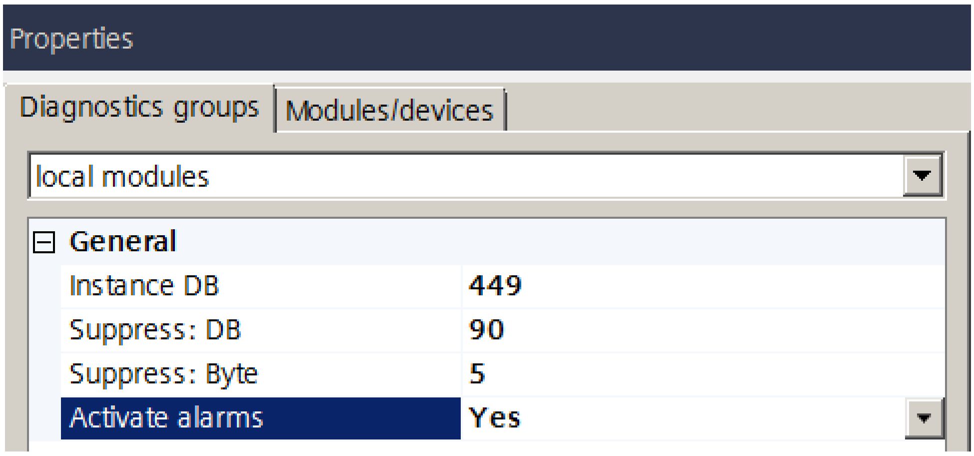


Fig. 173: PROFIBUS/PROFINET diagnostics Properties > Diagnostic groups

Note	If you have activated alarms, you should use the **FB_PROFIB_N_ALARM** (FB447) function block to capture failures of short duration.

7.2.1.2 MV400/500 connected as PN-IO node

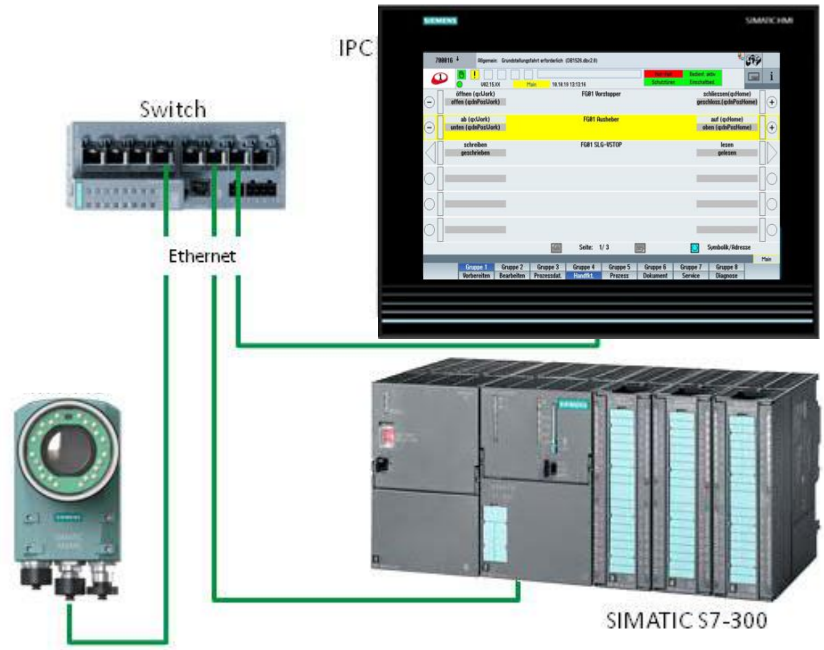


Fig. 174: MV440 connected as PN-IO node

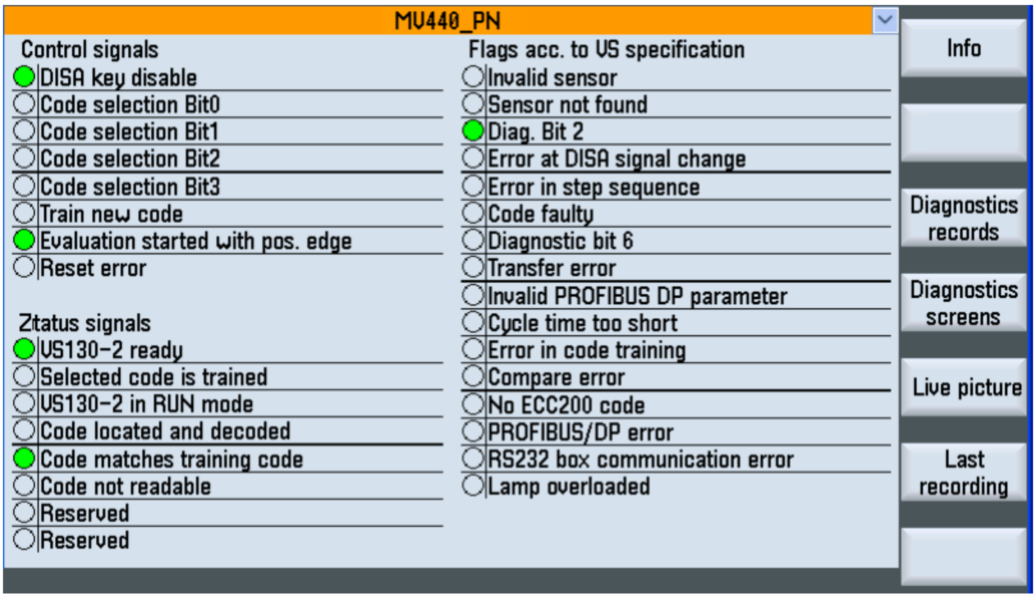


Fig. 175: HMI PRO RT: MV4x0 diagnostics as PN-IO node

The **FB79_APPLICATION** (FB79) of the camera must be used if the MV4x0 camera is connected directly as PN-IO node (MV4x0_PN).

The **FB_SL_COM** (FB449) is required for the diagnostics of an MV4x0 camera system as a PN-IO node with HMI PRO RT.

The following must be configured in **HMI PRO CS**:

- Instance DB for **FB_SL_COM**
- Input and/or output address:
  Addresses of the control byte
- Diagnostic address:
  Diagnostics address of the MV4X0 PN module from the STEP 7 hardware configuration.
- IP address or computer name:
  IP address of camera web parameters

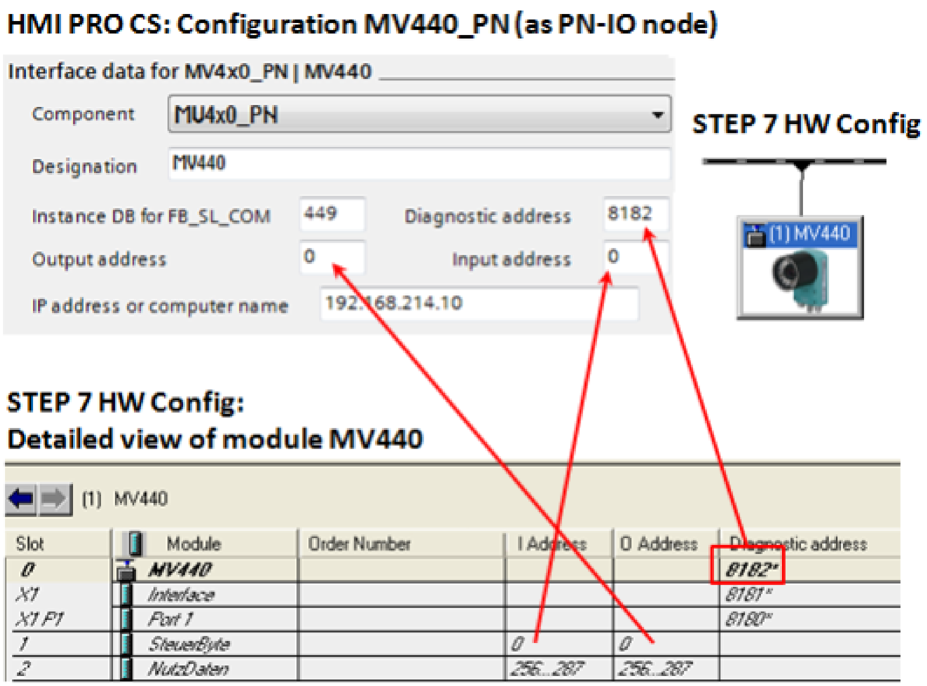


Fig. 176: HMI PRO CS: MV4x0 as PN-IO node, addresses from STEP 7

7.2.1.3 Settings for RF300

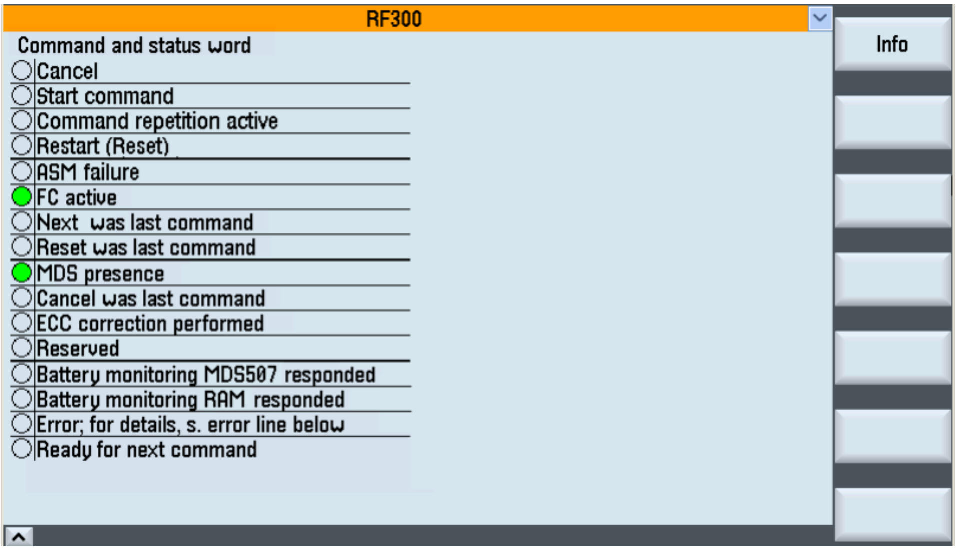


Fig. 177: HMI PRO RT: RF300 diagnostics

The following RFID components can be diagnosed with HMI PRO RT:

- ASM 450, ASM 452, ASM 456, ASM 473, ASM 475
- RF170C, RF180C

No additional block is required for diagnosis of the RF300 components with HMI PRO RT.

Since the user controls the functions of the RF300 components using standard SIEMENS FB45/FB55 blocks, the following must be specified in **HMI PRO CS**:

- FC type:
  FC/FB used
- Parameter DB or command data DB:
  Associated MOBY data block number
- SLG offset (only for FC/FB type 45/55):
  Offset of the MOBY module data structure in the MOBY data block

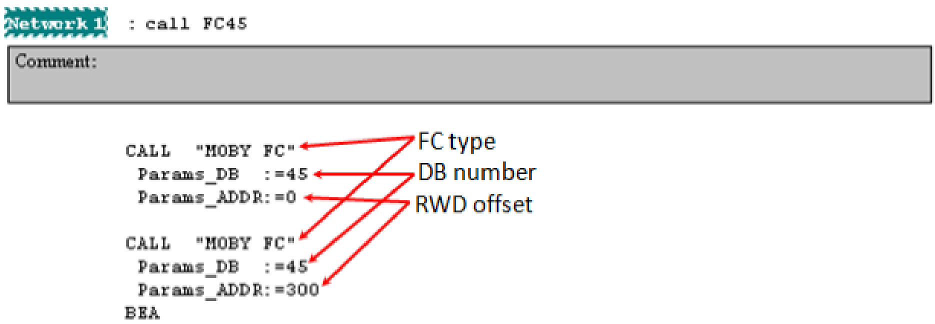


Fig. 178: RF300 example

7.2.1.4 Settings for SINAMICS S120

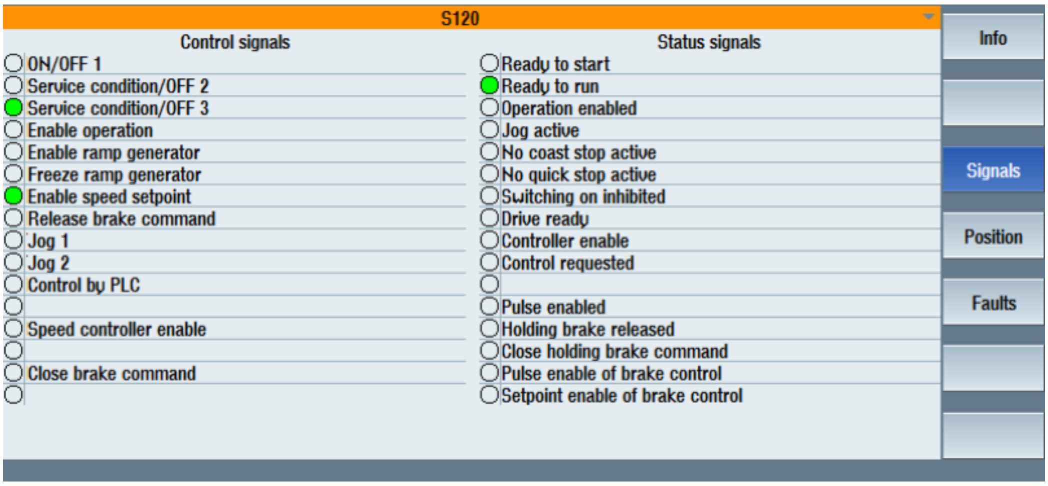


Fig. 179: HMI PRO RT: S120 control/state signals diagnostics

If the S120 drive is used in spindle mode, only the status signals are displayed.

FB_SL_COM (FB449) is required for the diagnostics of SINAMICS S120 with HMI PRO RT.

The following must be configured in **HMI PRO CS**:

- Instance DB for **FB_SL_COM**
- Diagnostic address:
  Diagnostics address for the SINAMICS S120 drive must be taken from the STEP 7 hardware configuration.
- Drive object no.:
  Number of the drive object from the STARTER engineering software for SINAMICS drives.
- Check box for S120 state signals diagnostics - positioning operation
  Selection of the dimension system for displaying the axis

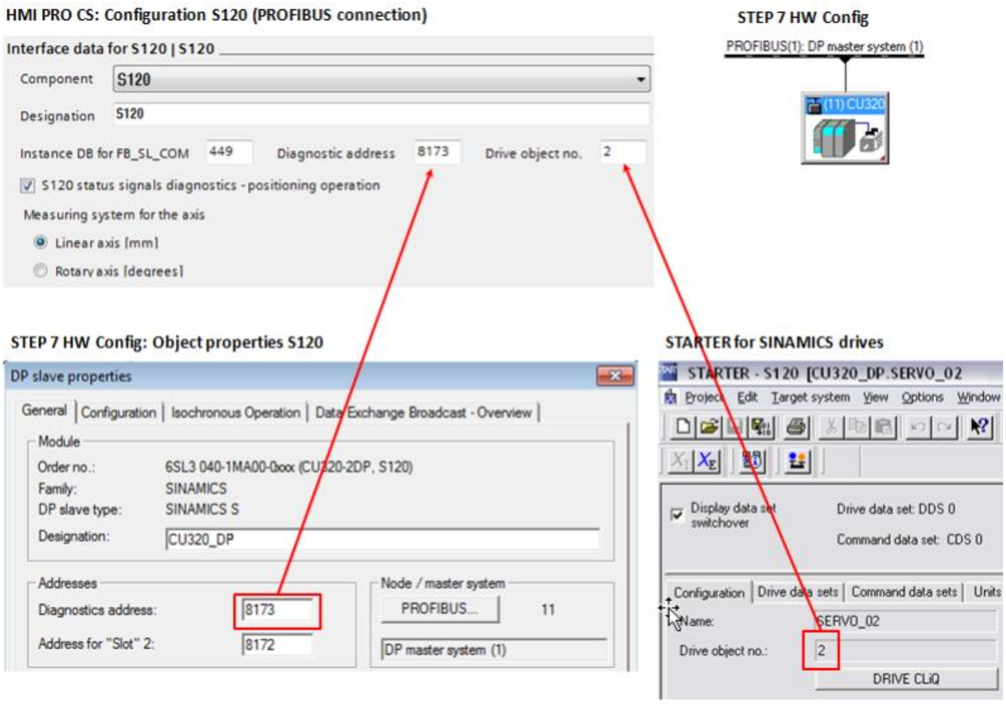


Fig. 180: HMI PRO CS: Diagnostic address S120 (PROFINET connection) from STEP 7

7.2.1.5 Settings for converters

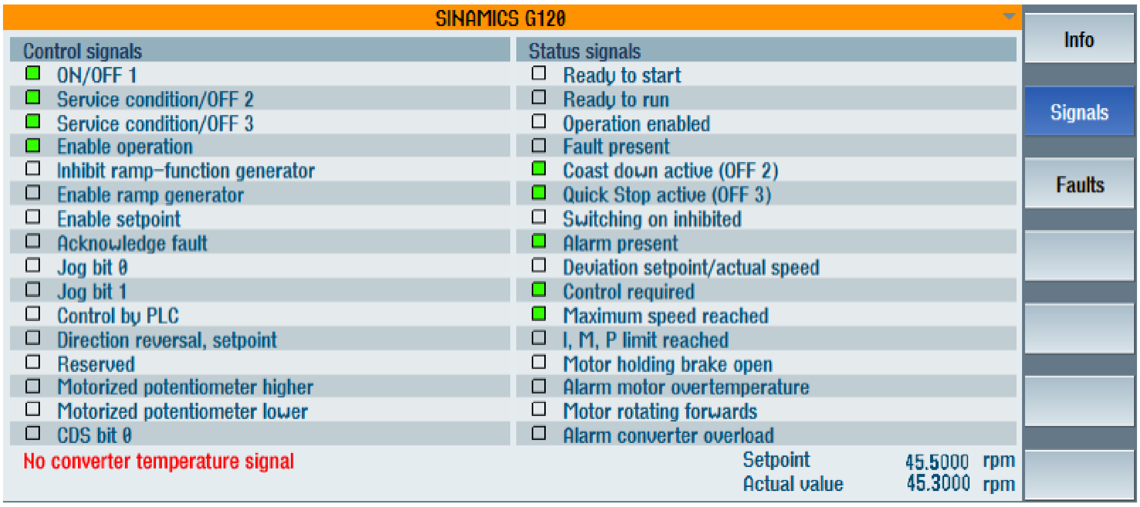


Fig. 181: HMI PRO RT: Converter diagnostics

The **FB_SL_COM** (FB449) is required for the diagnostics of the converters with HMI PRO RT.

The following converters can be diagnosed with HMI PRO RT:

- SINAMICS G110M
- SINAMICS G120
- SIMATIC ET200pro FC-2

The following must be configured in **HMI PRO CS**:

- Interface DB: Instance DB of the **FB_SL_COM**
- Diagnostic address: Diagnostics address for the converter from the hardware configuration in STEP 7

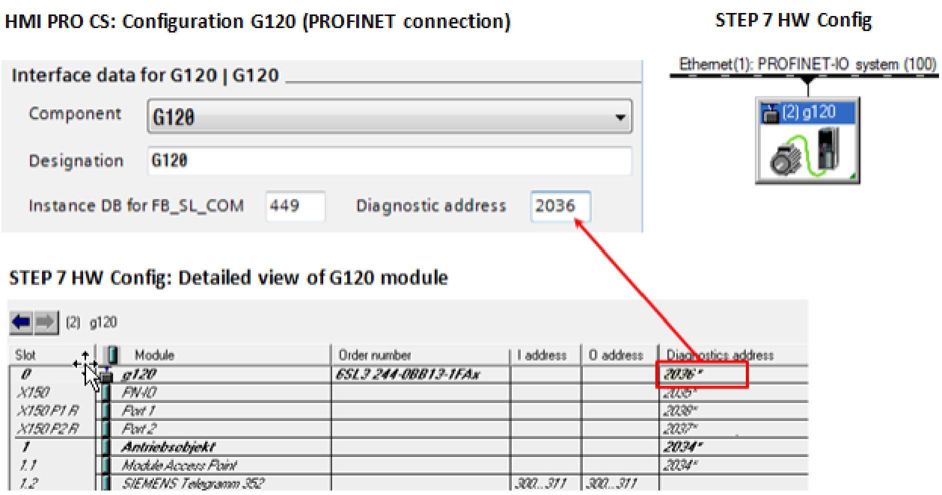


Fig. 182: Diagnostics address G120 (PROFINET connection) from STEP 7

7.2.1.6 Settings for motor starters

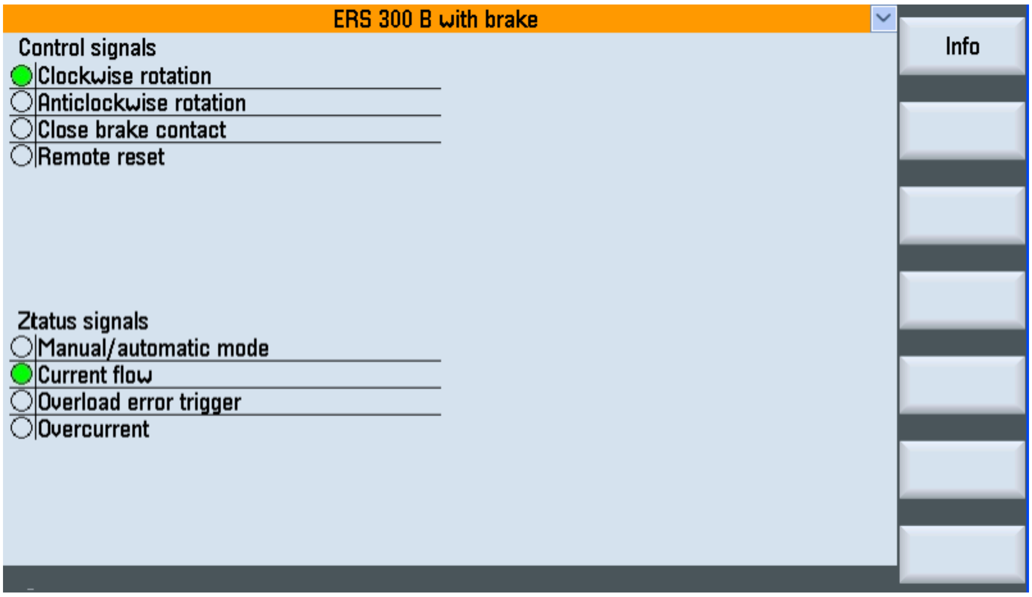


Fig. 183: HMI PRO RT: Motor starter diagnostics

The following motor starters can be diagnosed with HMI PRO RT:

- EDS 300
- EDS 300 B
- ERS 300
- ERS 300 B

No additional block is required for the motor starter diagnostics with HMI PRO RT.

The following must be configured in HMI PRO CS:

- Input address:
  input address from the hardware configuration in STEP 7
- Output address:
  output address from the hardware configuration in STEP 7

For motor starters, the diagnostics is read out via the input and output address of the process image.

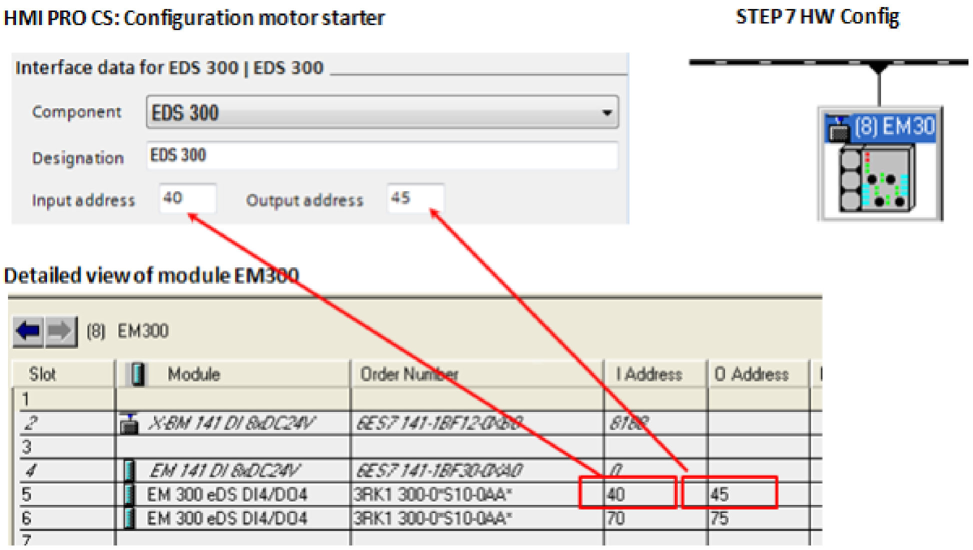


Fig. 184: HMI PRO CS: Input and output address for a motor starter from STEP 7

7.3 Error and operating messages

7.3.1 SIN_ALARM_SERVER (DB2) standard alarm system

7.3.1.1 General information

As a rule, there are two alarm systems integrated on the HMI device.

Standard alarm system for SINUMERIK:

The standard alarm system is activated via **SIN_ALARM_SERVER** (DB2) and requires the SINUMERIK basic system for display purposes. **AL_MSG** (FC10) is provided for message acquisition. It acquires the events to be reported, divided into signal groups, and reports them to the HMI device via the diagnostic buffer.

Bit arrays for the events, which relate to the VDI interface, are summarized in **SIN_ALARM_SERVER**, together with bit arrays for user messages.

Note	The area (VDI interface) is not required for a link between S7 and HMI device. This data area in the SIN_ALARM_SERVER is reserved for the SINUMERIK 840D sl.

Evaluation 1

Acquisition of error messages

A fixed area specification exists to define the signals within a group, which generate an error message when they change from "0" to "1".

Evaluation 2

Acquisition of operational messages

A fixed area specification exists to define the signals within a group, which generate an operational message. The scope of user bit arrays (user area) is set to 10 areas of 8 bytes as the default setting.

See also: Documentation for SINUMERIK 840D sl.

7.3.1.2 Acknowledgment concept

The following acknowledgment concepts are defined for error and operational messages:

Operating messages

Operating messages are intended for the display of normal

operating states as information for the user. Acknowledgment signals are, therefore, not required. An entry is made in the diagnostic buffer for incoming and outgoing messages. The HMI device (e.g. IPC) generates an up-to-date log of the pending operational messages using the "OM in" and "OM out" identifiers.

Error messages

Error messages display error states on the machine that

generally lead to a machine stoppage. If several errors occur "simultaneously",

it is important to be able to distinguish their order of occurrence for troubleshooting purposes. This is indicated, on one hand, by the order in which they are entered in the diagnostic buffer and on the other, by the time stamp, which is assigned to every entry. If the cause of the error disappears, the error message is only deleted if the user has acknowledged the message (e.g. by pressing a key on the machine control panel). In response to this signal, **AL_MSG** investigates which of the reported errors have disappeared, and enters these in the diagnostic buffer with the entry "Error out". This allows the HMI device to generate an up-to-date log of pending error messages. The time of day indicating the time at which the error occurred is maintained for messages, which are still pending (in contrast to a new query).

7.3.1.3 AL_MSG (FC10) function description

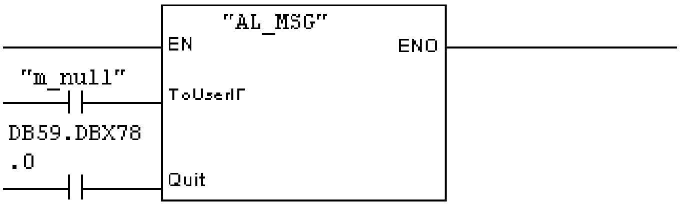


Fig. 185: AL_MSG

Parameter	Data type	Description
ToUserIF	BOOL	1=Signals transferred to user interface in each cycle
Ackn	BOOL	2=Error message acknowledgment

Table 49: Formal parameter AL_MSG

Description:

The signals entered in **SIN_ALARM_SERVER** are evaluated using **AL_MSG** and displayed on the HMI device as occurring and back-to-normal operational messages. The occurring signals (positive edge) are displayed immediately in the case of both error and operational messages. Back-to-normal signals (negative edge) are only canceled immediately in the case of operational messages. Error messages remain stored on the HMI - even if the signals no longer exist - until the user acknowledges the messages by issuing the **acknowledge** parameter.

The **ToUserIF** parameter can be used to transfer the group signals for the feed, read and NC start disabling signals and feed stop signal to the existing axis, spindle and channel interfaces.

1. If **ToUserIF**=FALSE, signals are not transferred to the user interface. In this case, the user has to ensure that these signals are influenced in the interface using his PLC program (only applies to link between SINUMERIK 840D sl and HMI device).
2. If the parameter **ToUserIF**=TRUE, all signals listed above are transferred to the user interface as group signal respectively. Therefore, the PLC program of the user can only influence the signals listed above via the **SIN_ALARM_SERVER** in conjunction with issuance of a message or alarm. The appropriate information is overwritten in the user interface.

7.3.1.4 Structure of SIN_ALARM_SERVER

SIN_ALARM_SERVER offers the user the opportunity to display messages on the operator panel

using individual signals, provided that the MMC basic system is used. The signals are subdivided into defined groups, as shown in the table below. When a message occurs, disappears or is acknowledged, the number listed in the **Message number** column is transferred to the HMI device. A text can be stored in the HMI device for each error/message number of the user area via HMI PRO CS.

Address	Type	Initial value	Comment	Message number
DBX 0.0 ... 7	BOOL	FM	Standard interface for 840D	510,000 –
DBX 159.0 ... 7	BOOL	OM	Standard interface for 840D	600,815
DBX 180.0 ... 7	BOOL	FM	User area 0: Byte 1	700,000 – 700,007
DBX 181.0 ... 7	BOOL	FM	User area 0: Byte 2	700,008 – 700,015
DBX 182.0 ... 7	BOOL	FM	User area 0: Byte 3	700,016 – 700,023
DBX 183.0 ... 7	BOOL	FM	User area 0: Byte 4	700,024 – 700,031
DBX 184.0 ... 7	BOOL	OM	User area 0: Byte 5	700,032 – 700,039
DBX 185.0 ... 7	BOOL	OM	User area 0: Byte 6	700,040 – 700,047
DBX 186.0 ... 7	BOOL	OM	User area 0: Byte 7	700,048 – 700,055
DBX 187.0 ... 7	BOOL	OM	User area 0: Byte 8	700,056 – 700,063
DBX 188.0 ... 7	BOOL	FM	User area 1: Byte 1	700,100 – 700,107
DBX 189.0 ... 7	BOOL	FM	User area 1: Byte 2	700,108 – 700,115
DBX 190 ... 7	BOOL	FM	User area 1: Byte 3	700,116 – 700,123
DBX 191 ... 7	BOOL	FM	User area 1: Byte 4	700,124 – 700,131
DBX 192 ... 7	BOOL	OM	User area 1: Byte 5	700,132 – 700,139
DBX 193 ... 7	BOOL	OM	User area 1: Byte 6	700,140 – 700,147
DBX 194 ... 7	BOOL	OM	User area 1: Byte 7	700,148 – 700,155
DBX 195 ... 7	BOOL	OM	User area 1: Byte 8	700,156 – 700,163
to	"	"	to	to
DBX 372.0 ... 7	BOOL	FM	User area 24: Byte 1	702,400 – 702,407
DBX 373.0 ... 7	BOOL	FM	User area 24: Byte 2	702,408 – 702,415
DBX 374.0 ... 7	BOOL	FM	User area 24: Byte 3	702,416 – 702,423
DBX 375.0 ... 7	BOOL	FM	User area 24: Byte 4	702,424 – 702,431
DBX 376.0 ... 7	BOOL	OM	User area 24: Byte 5	702,432 – 702,439
DBX 377.0 ... 7	BOOL	OM	User area 24: Byte 6	702,440 – 702,447
DBX 378.0 ... 7	BOOL	OM	User area 24: Byte 7	702,448 – 702,455
DBX 379.0 ... 7	BOOL	OM	User area 24: Byte 8	702,456 – 702,463

Table 50: Structure SIN_ALARM_SERVER

Note	Only the shaded area is enabled for a connection between S7 and the HMI device.

Connection SINUMERIK 840D sl and HMI device

The entire area is enabled. For expansion to 25 user areas,

in OB100, on the following function block the parameter

MsgUser Int = 25

must be entered:

- FB_RUN_UP_S7 for SIMATIC PLC applications
- RUN_UP for NCU applications

7.3.1.5 Expanding the alarm system via DB_HMI_ALARM_SERVER (DB126)

The **DB_HMI_ALARM_SERVER** adds an additional 3000 faults and messages to the alarm system. Fault and message texts are configured in

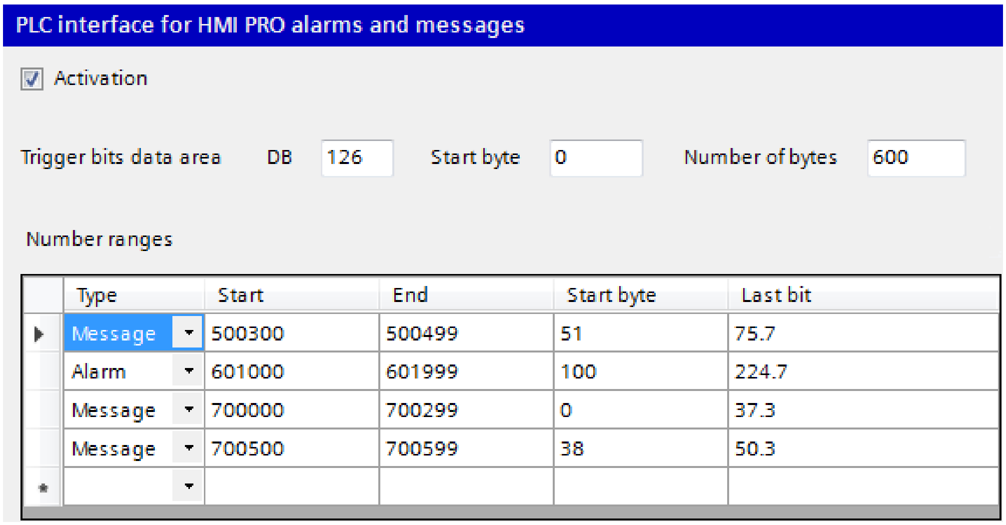
HMI PRO CS.

As with the standard alarm system, texts are displayed in the message window on alarm screens and in the system message line. The numbers are displayed in the **DB_HMI_ALARM_SERVER** from the number 700 000 up to the number 702 999, in accordance with the set bit.

Areas for **messages** or **faults** can be parameterized using the HMI PRO CS configuration software. Other supplementary conditions for evaluating errors

can also be defined.

Additional information regarding parameterization of the alarms can be obtained from the HMI PRO CS online help.



Type	Start	End	Start byte	Last bit
Message	500300	500499	51	75.7
Alarm	601000	601999	100	224.7
Message	700000	700299	0	37.3
Message	700500	700599	38	50.3

Fig. 186: PLC interface for HMI Pro alarms and messages

Note	The SIN_ALARM_SERVER standard alarm system can be used for SINUMERIK error messages. All errors and messages relating to the machine should be reported via DB_HMI_ALARM_SERVER. This results in uniformity of the alarm system across PLC and SINUMERIK units.

7.3.2 Fault and operational messages for SIMATIC-OPs

7.3.2.1 General information

The **DB_HMI_ALARM_SERVER** can also be used as an interface

for error and operational messages. Consequently, the same errors are displayed on all operator panels when using the IPC and SIMATIC-OP simultaneously.

7.3.2.2 Acknowledgment concept

The following acknowledgment concepts are implemented for

error and operating messages.

Operating messages

Operational messages are intended for the display of normal

operating states of the machine as information for the user. Acknowledgment signals are, therefore, not required. An entry is made in the operational message buffer for occurring and back-to-normal messages. The operator panel maintains an up-to-date log of existing operational messages using the identifiers **OM in** and **OM out**.

Error messages

Error messages display error states on the machine that

generally lead to a machine stoppage. If several errors occur **simultaneously**, it is important to be able to distinguish their order of occurrence for troubleshooting purposes. This is indicated, on one hand, by the order in which they are entered in the error message buffer and on the other, by the time stamp, which is assigned to every entry. If the cause of the error has disappeared, the error message is only cleared if the user has acknowledged the message.

7.3.2.3 Error message structure

Example

Double monitoring of grinding cylinders SE0.4 + SE0.5

Runtime monitoring of back grinding cylinders YP0.4 + SE0.4

7.3.3 "Info_Alarms_Prisma" (from project DVD)

Declaring detail messages as alarms for PRISMA

Detail messages that are generated during active alarm handling as part of special HMI PRO PB/PN diagnostics, can be specifically declared as alarms so that they are also sent to PRISMA.

The following detail messages exist:

909012 - PROFINET module diagnostics

909014 - PROFINET channel diagnostics

909013 - PROFIBUS module diagnostics

909015 - PROFIBUS channel diagnostics

909016 - PROFIBUS diagnostics repeater

They are changed to alarms in the HMI PRO project.

For a project that has been created with HMI PRO CS V8.0, this is done in file **sltlpropbpndiag.ini** in directory **proj**.

Thee following example declares PROFINET channel diagnoses and PROFIBUS channel diagnoses as alarms:

sltlpropbpndiag.ini

```
[Global]
Alarms=909014, 909015
```

7.4 Description of screens etc.

7.4.1 Softkey structure (StartUpSet)

The document "Softkeystructure SINUMERIK Operate for HMI Pro" can be found on the StartUpSet under startupset / hmitexts.

It contains all screens that are used in the Daimler environment including information about the individual screens.

The softkey structure contains screen trees of 3 different plant /control system types:

Production S7-300 / Assembly S7-300 / Assembly S7-1500

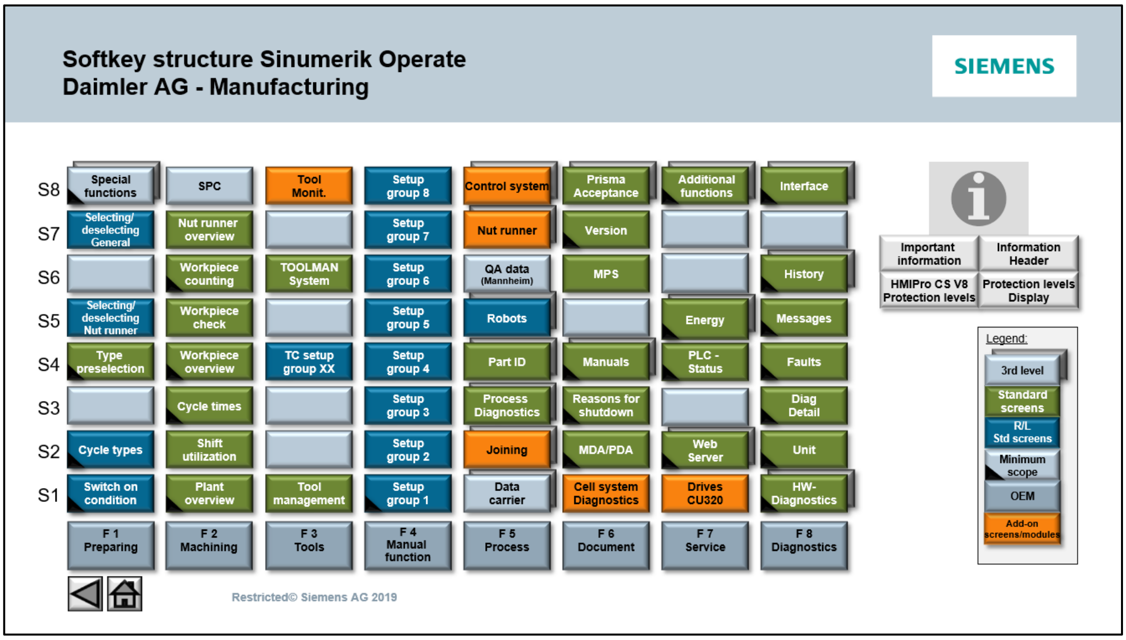


Fig. 187: Screen tree Production

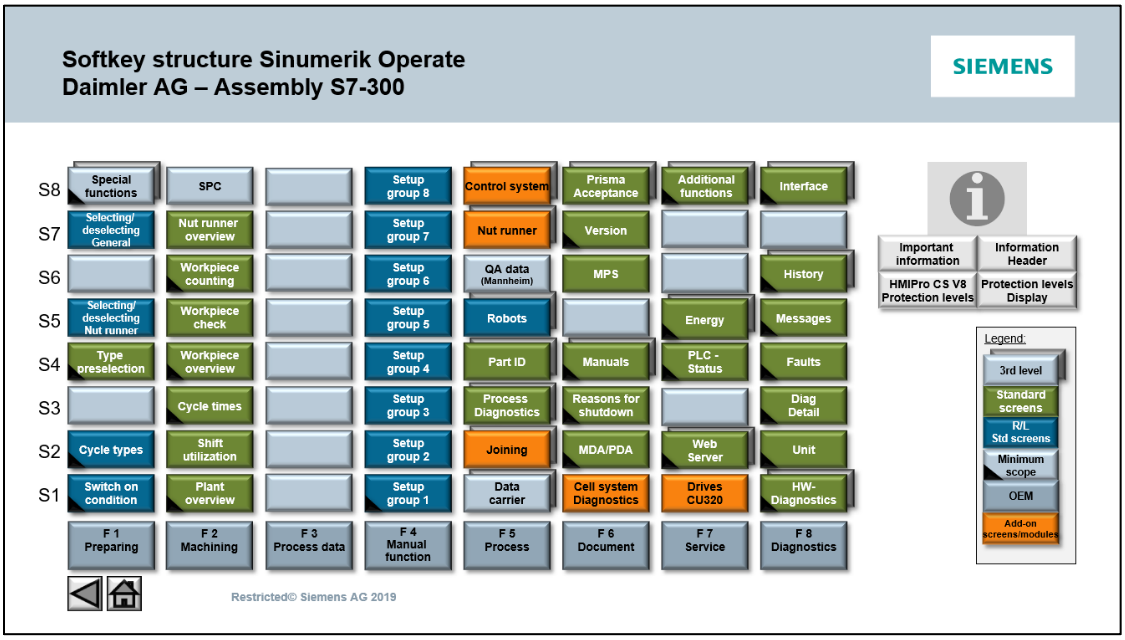


Fig. 188: Screen tree Assembly S7-300

Example help with screen "Cell system"

The call function (press the button of the screen) calls up the screen that contains the jump to the Help of the screen in question.

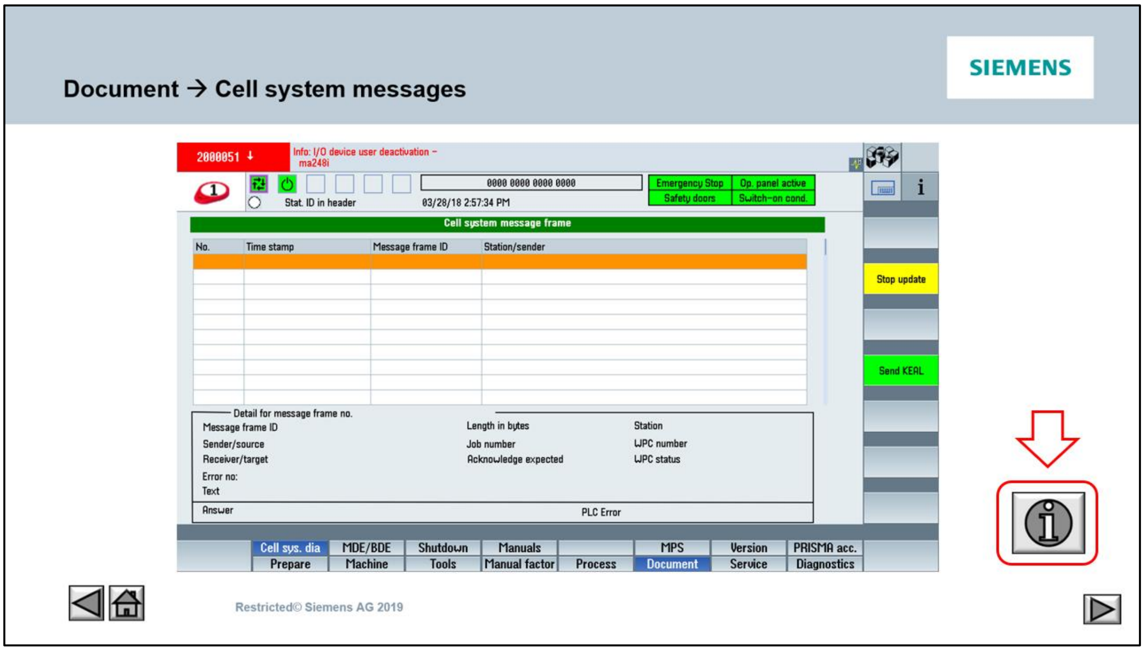


Fig. 189: Cell system telegrams

Document → Cell system messages

SIEMENS

Documentation sources:

Requirement specification:

- 03_Teil_III_Elektrik\05_IT-Schnittstellen_und_Systeme\03_Zellsystem\Zellsystem.pdf

- 03_Teil_III_Elektrik\05_IT-Schnittstellen_und_Systeme\01_Anlagen
  - Anlage_01_-_LH-Anlage_Standardisiertes_Motoretikett_v1.0.pdf
  - Anlage_02_-_Stammdaten-PLA-Schnittstelle_v3.4.pdf
  - Anlage_03_-_Telegramme-PLC-Zellsystem_(ADOK)_v4.10.pdf
  - Anlage_04_-_ZS-PF-Allgemeine_XML-Schnittstelle_zu_Partnersystemen_v1.13.pdf
  - Anlage_05_-_Standard-Telegrammverkehr_v4.7.pdf
  - Anlage_06_-_Funktionen_und_Parameter.pdf

- 03_Teil_III_Elektrik\05_IT-Schnittstellen_und_Systeme\02_Stammdatenvorlage
  - 01_Funktionsbeschreibung_Stammdaten_Excel-Liste.pdf
  - 02_Stammdatenvorlage_V13.zip

Notes from/about HMI Pro CS: **Control system Cell syst**

- The Cell system Diagnostics screen is not part of the minimum scope.
- The screen cannot be edited, see requirement specification for use.

Restricted© Siemens AG 2019

Fig. 190: Cell system telegram help

7.4.2 HMI Pro text project

A complete HMI text project with the Daimler-specific screen tree is also available on the StartUpSet under **startupset / hmitexts**.

20190222_Changelog_HMITextprojekte.txt	15.03.2019 16:39	TXT-Datei	3 KB
DAG_300_201902.zip	15.03.2019 16:45	zip Archive	1.743 KB
DAG_1500_201902.zip	15.03.2019 16:44	zip Archive	1.740 KB
Daimler_Nomenklatur.png	29.03.2018 10:04	PNG-Bild	180 KB
DE_HMIProSoftkeystrukturDaimler_2019_02V3.pptx	15.03.2019 16:38	Microsoft Office P...	6.161 KB
EN_HMIProSoftkeystrukturDaimler_2018_12V0.2.pptx	20.12.2018 07:31	Microsoft Office P...	5.013 KB
Thumbs.db	14.10.2019 09:32	Data Base File	46 KB

Fig. 191: Text project and softkey structure files

7.5 Relationship between the "Axis Selection" screen and control blocks

7.5.1 Axis selection screen in HMI PRO

The **Axis selection** screen gives the operator the opportunity to display axis data

or to select an axis. For applications with HT8 or for the use of an IPC without MCP or MPP, the screen can be used for selecting the TRANSLINE functions.

The **Axis selection** screen is always required when using one of the HMI devices MPP, MCP, HT8 or HT2. When HT8 is used or an IPC is used without MCP or MPP, softkeys for the TRANSLINE functions (AUT, SM, SSM, etc.) are also shown in addition to the axis data.

In HMI PRO CS, softkeys for the NC functions MDA and VAR INC for traversing the axis with variable increments can optionally be configured. The texts of the U keys image can also be changed.

Call of Axis selection screen

The **Axis selection** screen is opened by pressing the **Next Axes** key on the MPP/MCP

or the U key on HT8. The required axis can be selected using the cursor keys. Press the **Apply** button to write it to the parameterized area. Pressing the **Exit**, **Next Axis** or **U key** returns to the application that was previously selected.

7.5.2 Configuration in HMI PRO CS when connecting to an NC control

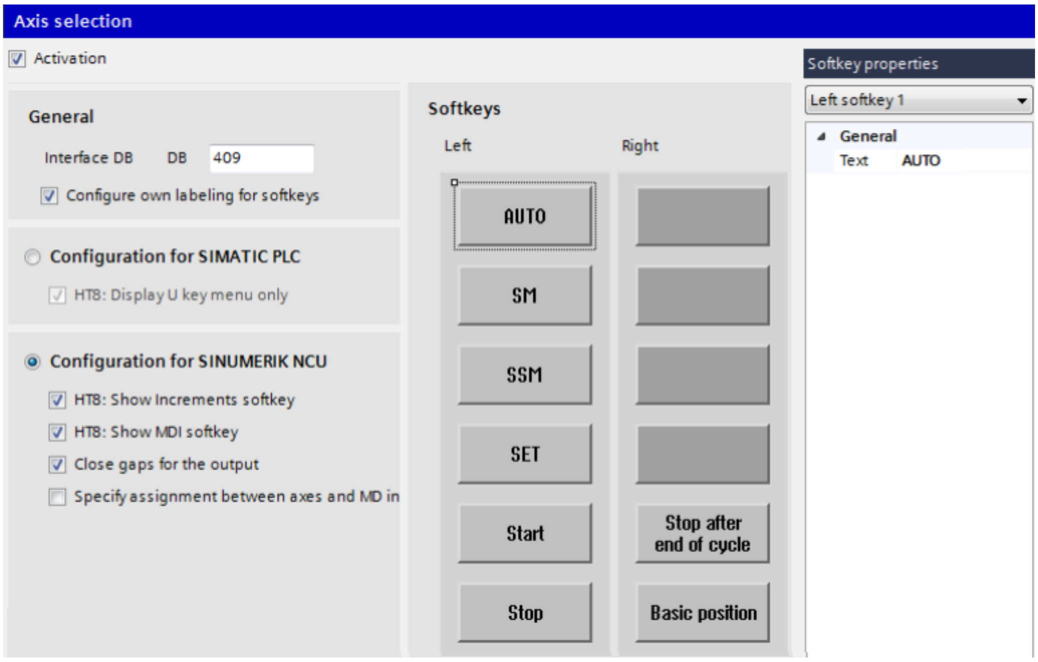


Fig. 192: Configuring the axis selection in HMI PRO CS (NC connection)

Activation

Activates the **Axis Selection** screen in HMI PRO RT → **must** be activated

General information

Interface DB

Entering the interface data block for axis selection. The DB409 has to be entered here.

Configuring your own softkey inscription → optional

For HT8 – or when using the axis selection screen without MPP – allows users to label U keys using their own text. The softkeys used for labeling are displayed. If this function is used, the FC_HT8 or FC_OP_TL_FM must be appropriately adapted.

Configuration for SINUMERIK NCU

HT8: Show Increments softkey

Displays the Increments softkey on the HT8 → must be activated

HT8: Show MDI softkey

Displays the MDI softkey on the HT8 → must be activated

Close gaps for the output

→ optional

With use of the machine coordinate system (MCS): Closes gaps on the keyboard layout of the MPP/MCP that occur due to unused axes.

Depending on the coordinate system used, the following applies:

- MCS (machine coordinate system)

  All of the machine axes configured on the NCU are displayed taking into account axis gaps and visualization specifications in the channels. The axis names specified in the general machine data are displayed.

- WCS (Workpiece Coordinate System)

  All of the axes configured in the channel are displayed taking into account

  axis gaps and visualization specifications in the channels.

  In HMI PRO, the configured geometry axes are displayed in the upper table and the channel axes not used as geometry axes are displayed in the lower table. The axis names specified in the channel-specific machine data are displayed.

  As of HMI PRO sl ≥ V04.05.03.03, only the GEO axes are available for selection

  via a key on the machine control panels (MPP, MCP und HT2).

  All other axes can only be selected from the axis selection screen.

Specify assignment between axes and MD index

- Activated

  The configuration relates exclusively to the MCS (machine coordinate system). It has no effect on the display in the WCS (workpiece coordinate system).

  The axes to be displayed are selected via HMI PRO.

The following applies:

All of the axes configured in HMI PRO CS are displayed in the configured sequence. A check is not made regarding a match of the following:

Machine axes configured on the NCU

Axis gaps

Visualization specifications in the channels

- Not activated

  The display of the axes that can be selected is only dependent on the machine data

  configured on the NCU.

7.5.3 Configuration in HMI PRO CS when connecting to a PLC control

When linking to a PLC control, the axis selection screen can be used to select TRANSLINE functions. In the following, this screen is called the
U keys screen.

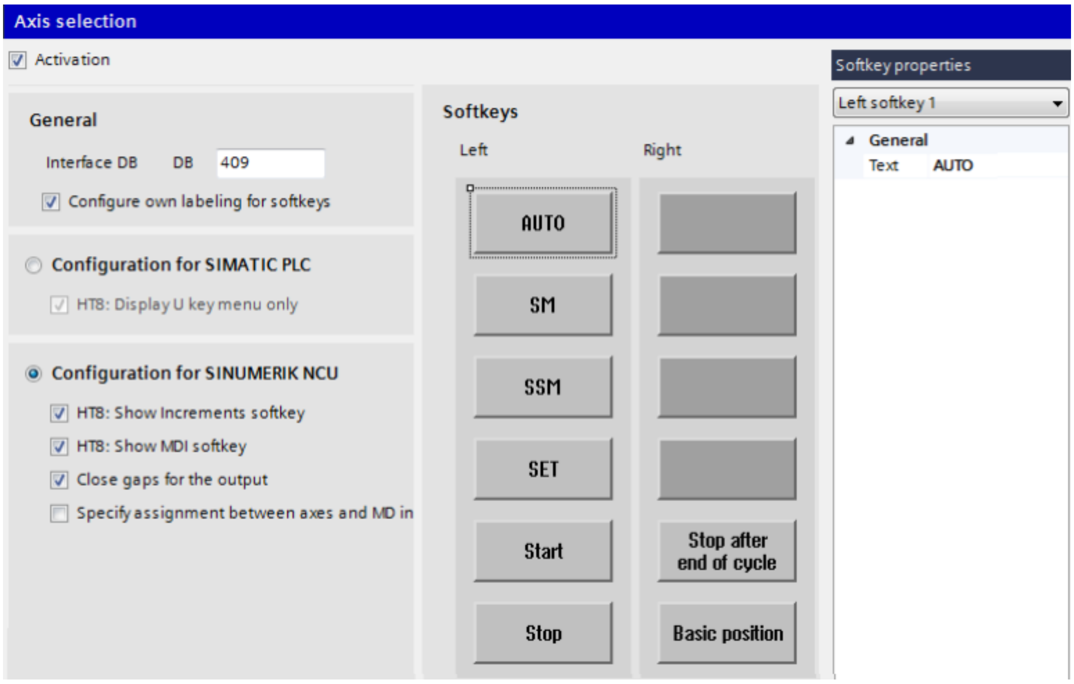


Fig. 193: Configuring the axis selection in HMI PRO CS (PLC connection)

Activation

Activates the **Axis Selection** screen in HMI PRO RT → **must** be activated

General information

Interface DB

Entering the interface data block for axis selection.

The DB409 has to be entered here.

Configuring your own softkey inscription → optional

For HT8 – or when using the axis selection screen without MPP – allows users to label U keys using their own text. The softkeys used for labeling are displayed. If this function is used, the DB_HT8 (DB402) or DB_OP_TL_FM (DB 405) must be appropriately adapted.

Configuration for SIMATIC PLC

HT8: display only U key menu

Deactivates access to NCU data → must be activated

This means that in the axis selection screen, the TRANSLINE functions (U keys) can be selected.

7.5.4 Settings in the FC_NC_FM block

Additional settings for the **Axis selection** screen can be made via the parameter

DIALOG_ENABLE. It also contains the feedback message as to whether the screen is active.

Header display

The header display can be displayed using parameter

DIALOG_ENABLE bit 2 = TRUE. A display of the selected axis is shown in the top right-hand area. This is only possible for configurations with a SINUMERIK 840 sl control.

Locking the axis selection

Axis selection can be locked using parameter

DIALOG_ENABLE bit 3 = TRUE. The screen can still be used for monitoring.

MCS axis selection

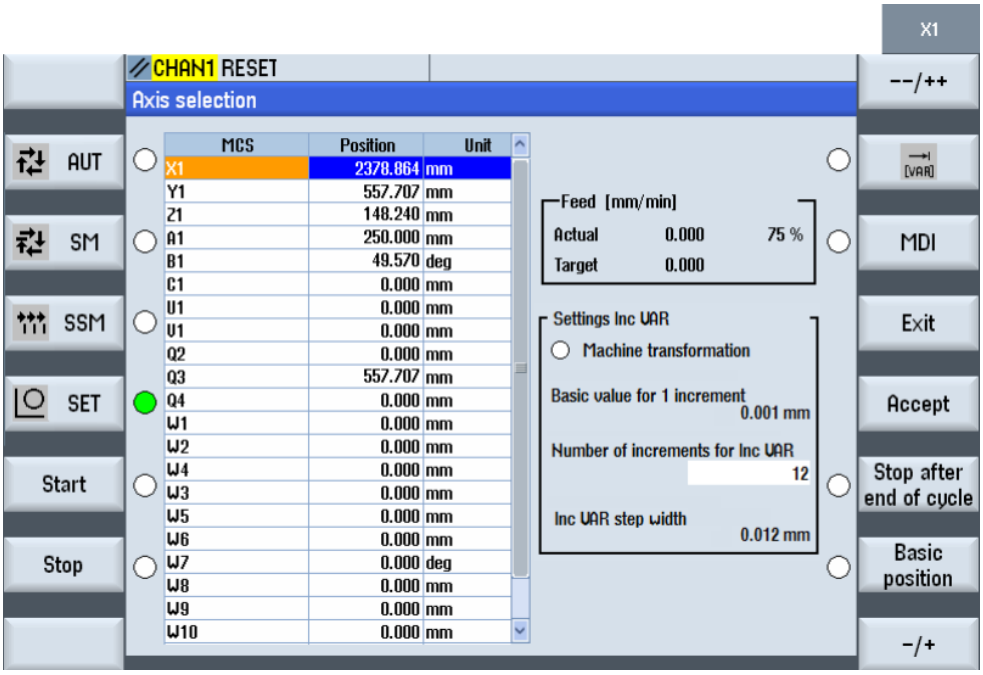


Fig. 194: MCS axis selection at the HT8

The activation bit 0 in the DIALOG_ENABLE parameter enables the Axis selection screen in the MCS. It shows either all axes configured in HMI PRO CS in the sequence of their configuration or all machine axes configured on the NCU taking account of the axis gaps and visualization specifications in the channels. The axes are displayed using the name specification in the general machine data. The position is shown in the machine coordinate system (MCS). In the feed area, the actual value and the setpoint of the selected axis as well as the feed/spindle override are displayed depending on the function of the axis. HMI PRO CS can be used to assign different names to the TRANSLINE-specific function keys.

Axis selection WCS

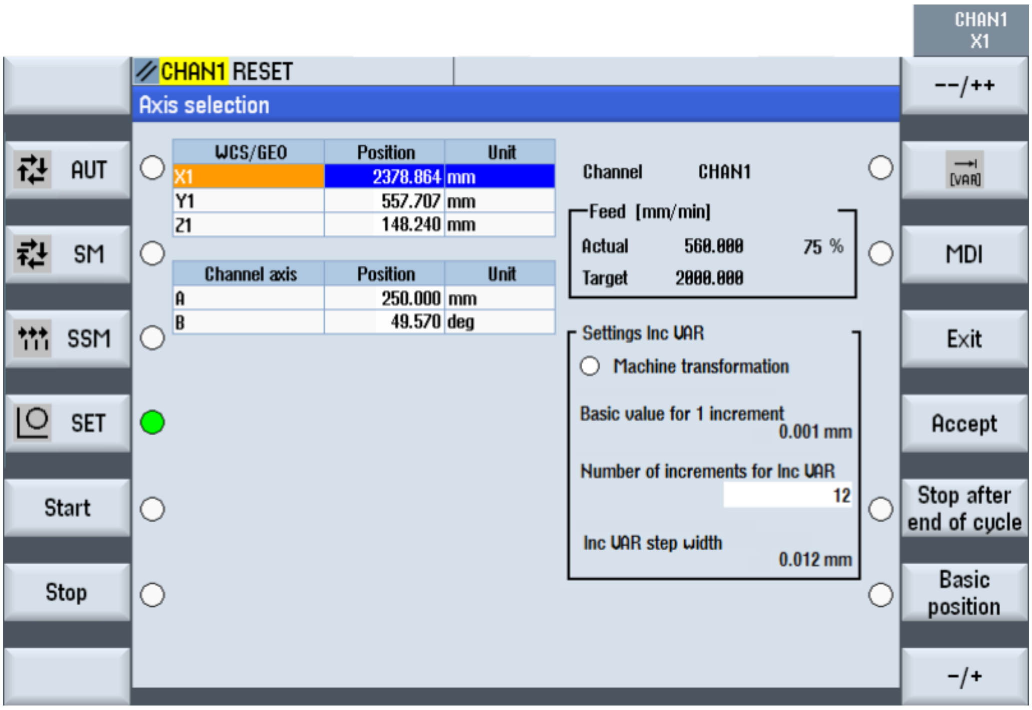


Fig. 195: WCS axis selection at the HT8

The activation bit 1 in the **DIALOG_ENABLE** parameter enables the **Axis selection** screen in the WCS. All of the axes configured in the channel are displayed taking into account axis gaps and visualization specifications in the channels. In HMI PRO RT, the existing geometry axes are displayed

in the upper table and those channel axes not used as geometry axes are

displayed in the lower table. The axis names specified in the channel-specific machine data are displayed. The position of the geometry axes is displayed in the workpiece coordinate system (WCS). In the feed area, the actual value and the setpoint of the selected axis as well as the feed/spindle override are displayed depending on the function

of the axis.

Selecting axes from MPP MCP and HT2 is just restricted to GEO axes. The remaining channel axes can only be selected from the axis selection screen.

HMI PRO CS can be used to assign different names to the TRANSLINE-specific function keys.

Feedback signal

The feedback message from HMI PRO takes place via the **FC_NC_FM** (FC409),

parameter **DIALOG_ENABLE** bit 7; with it, it can be checked if the Axis selection screen is active (TRUE = Axis selection active).

7.6 Special features of HMI PRO with 1:N assignments (only released in combination with virtual stations)

7.6.1 General information

It is assumed that only one operator device MPP, HT8 is active.

1:1 configuration

For a 1:1 configuration, HMI PRO has a connection with an individual controller (SIMATIC PLC or SINUMERIK NCU).

Standard projects with a 1:1 configuration are also identified in the status bar 

1:N configuration

For a 1:N configuration, it is possible to visualize and operate up to 4 lower-level controllers with one operator panel (i.e. one IPC with one MPP; (several TCUs or HT8 are permitted)). These can either be SIMATIC PLCs or SINUMERIK NCUs. Mixed operation is not permitted. Virtual stations are not possible!

Note	This constellation has not been released!

An 1:N HMI PRO project contains a basic configuration (ROOT) and a control-specific configuration for each controller to be operated.

1:N projects are designated with  in the status list.

Virtual stations

With the aid of the configuration of virtual stations, it is possible to visualize up to 20 stations on the operator panel with one controller. This means that a station is the virtual image of a PLC on the actual SIMATIC PLC controller. A separate HMI PRO DB with a different number is generated for each station to be visualized. Permissible operator components are: one IPC with **one MPP** or **HT8.**

An HMI PRO project with virtual stations contains a basic configuration (ROOT) and, for each station to be visualized, a station-specific configuration in a dedicated data block. As a consequence, virtual stations operate with a multitude of standard HMI PRO DBs on a controller. Virtual stations are only permitted for a 1:1 connection.

Projects with virtual stations are designated with in the status bar.

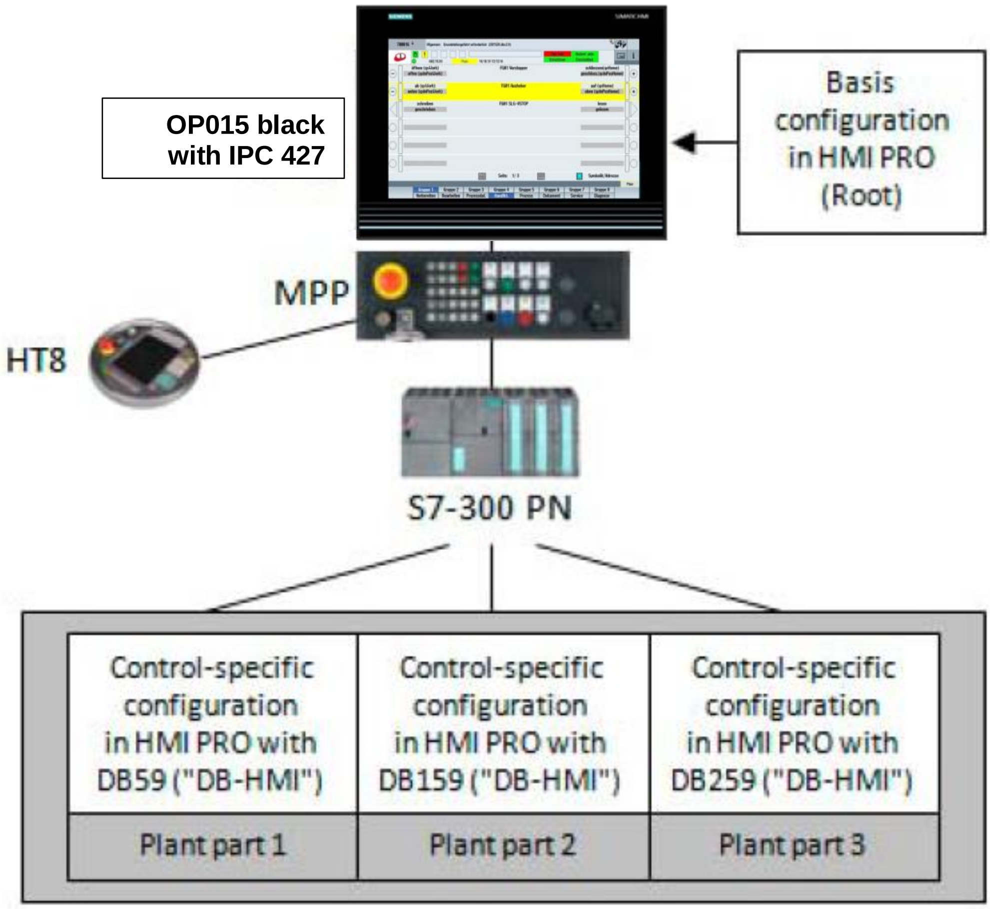


Fig. 196: Example for a configuration with 3 virtual stations

7.6.2 Configuration in HMI PRO CS

Controller

You configure 1:N projects with virtual stations in the project navigation under **Project name ► Control**. There, configure the connections from HMI PRO to the virtual stations with the HMI-PRO-DBs.

For the configuration, see the online help for HMI PRO CS.

7.6.2.1 Virtual stations a SIMATIC PLC

You can parameterize up to 20 connections from a controller to virtual stations.

Configure under **Controller type: SIMATIC S7-300** and under **Controller connection**: **Single connection**. Enter the **IP address of the control**, and activate check box **Project with virtual stations (separate DBs)**.

Under **Project name ► Control ► Configuration of the virtual stations,** configure the connections from HMI PRO to the virtual stations by assigning station names and HMI PRO DBs as well as alarm numbers.

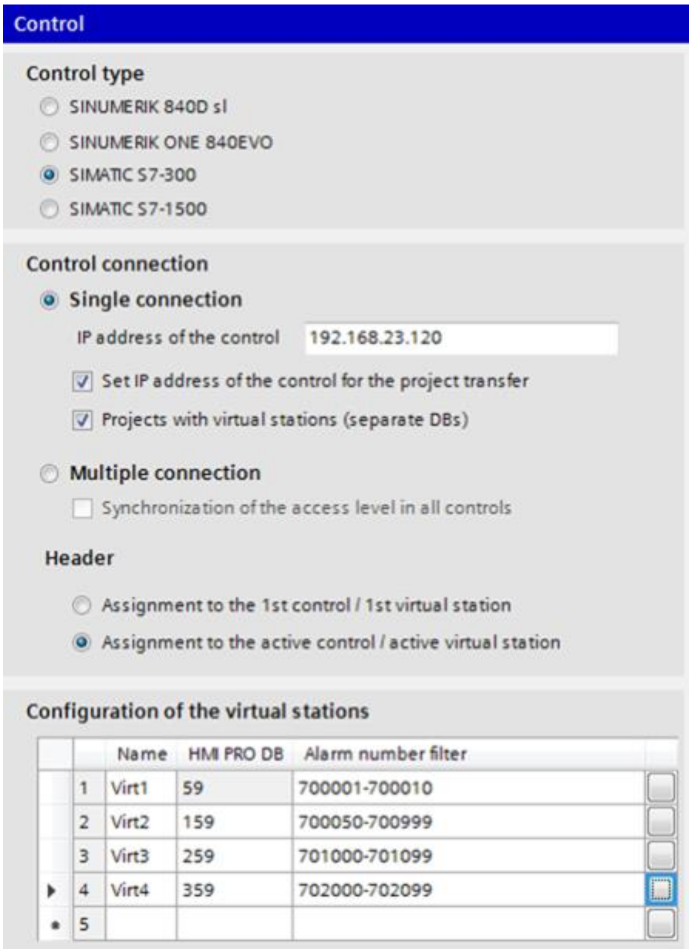


Fig. 197: Configuring HMI PRO DBs for virtual stations for SIMATIC PLC

Enter the following:

- Name: Station name
- HMI-PRO-DB: Enter the standard HMI DB [DB59] in the first line (Virt1); in the
  following lines (Virt2 to Virt20), enter
  the respective data block that you use for the station.
- Alarm number filter: Alarm numbers or number ranges that
  belong to the configured station

7.6.2.2 Virtual stations on an NCU

You can parameterize up to 20 connections from HMI PRO to virtual stations.

Configure under **Controller type: SINUMERIK 840D sl** and under **Controller connection**: **Single connection**. Enter the **IP address of the control**, and activate check box **Project with virtual stations (separate DBs)**.

Under **Project name** ▶ **Control** ▶ **Configuration of the virtual stations** configure the connections from HMI PRO to the virtual stations by assigning station names and HMI PRO DBs as well as alarm numbers, channels and axes.

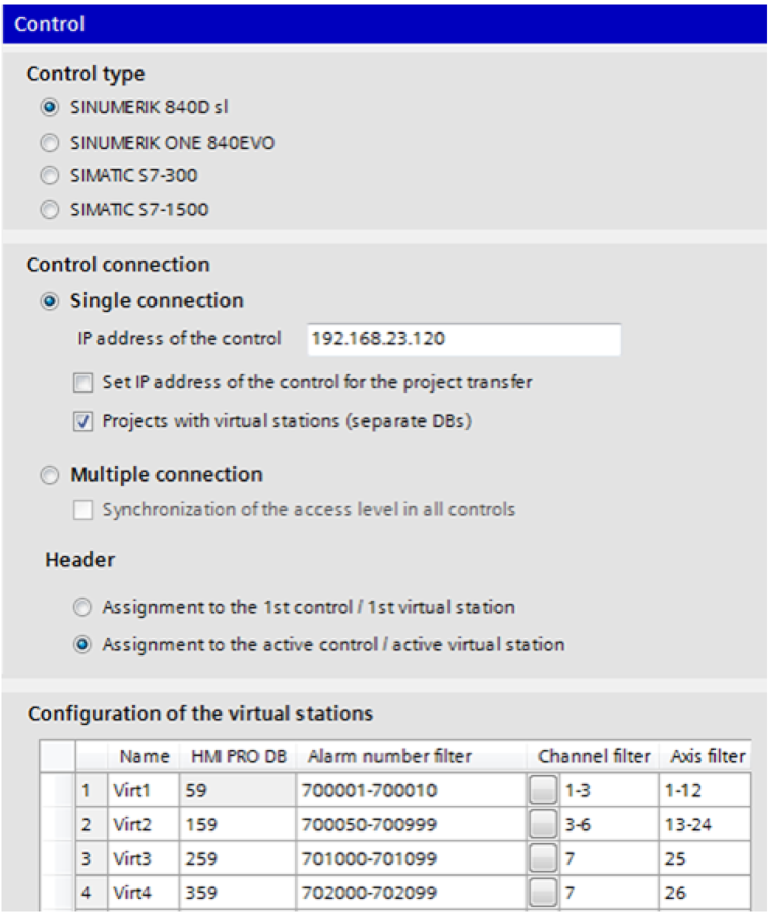


Fig. 198: Configuring HMI PRO DBs for virtual stations for NCU

Enter the following:

- Name: Station name
- HMI-PRO-DB: Enter the standard HMI PRO DB [DB59] in the first line (Virt1);

  in the following lines (Virt2 to Virt20),

  enter the respective data block that you use for the station.
- Alarm number filter: Alarm numbers or number ranges that

  belong to the configured station
- Channel filter: The channels that belong to the configured station
- Axis filter: The axes that belong to the configured station

Operating mode groups and virtual stations for an NCU

An operating mode group combines NC channels with axes and spindles

to form a machining unit. A mode group contains the channels that are required to always run in the same mode simultaneously from the point of view of the machining sequence. The configuration of a mode group

defines which channels are to be included in the group.

In HMI PRO CS, assign operating mode groups to the virtual stations. Assign the station names in such a way that they correspond to the mode group names.

Under **Project name** ▶ **Configuration** ▶ **Presettings** ▶ **Channel groups**, check the **Activation** check box. An editor window opens for making an entry.

Example of virtual station - mode group assignment

In the sections [CH_GRP_x], the respective mode groups are assigned to the virtual stations, e.g. in [CH_GRP_1], the virtual station BAG_1 is assigned to the mode group.

```
;*************************************************************************************
;                  netnames.ini      - EXAMPLE -
;
; This is an example of a netnames.ini for 1:1 NCU-switching in a configuration of
; 1 NCUs and a IPC.
; And additional an example for local channel switching per channel menu.
; See also Comissioning Manual, IM9
;
;*************************************************************************************
[own]
owner = HMI

;***************************
; ChanMenu
;***************************
[chan HMI]
ShowChanMenu = true

[T2M2N]
SK1 = CH_GRP_1
SK2 = CH_GRP_2
SK3 = CH_GRP_3

;*************************************************************************************
;Channel-groups
;Correlation from channel-group to horizontal softkeys → see config.ini of the TCU
;The section [T2M2N] can also be created in the netnames.ini file instead of
;config.ini file. This means that the channel menu for all TCUs is the same.
;*************************************************************************************

[CH_GRP_1]

Text = BAG_1
Member1.Target = #1
Member1.Text = $MC_CHAN_NAME

Member2.Target = #2
Member2.Text = $MC_CHAN_NAME


[CH_GRP_2]
Text = BAG_2
Member1.Target = #3
Member1.Text = $MC_CHAN_NAME

Member2.Target = #4
Member2.Text = $MC_CHAN_NAME

[CH_GRP_3]
Text = BAG_3
Member1.Target = #5
Member1.Text = $MC_CHAN_NAME

Member2.Target = #6
Member2.Text = $MC_CHAN_NAME
```

Fig. 199: Example of virtual stations - mode group assignment

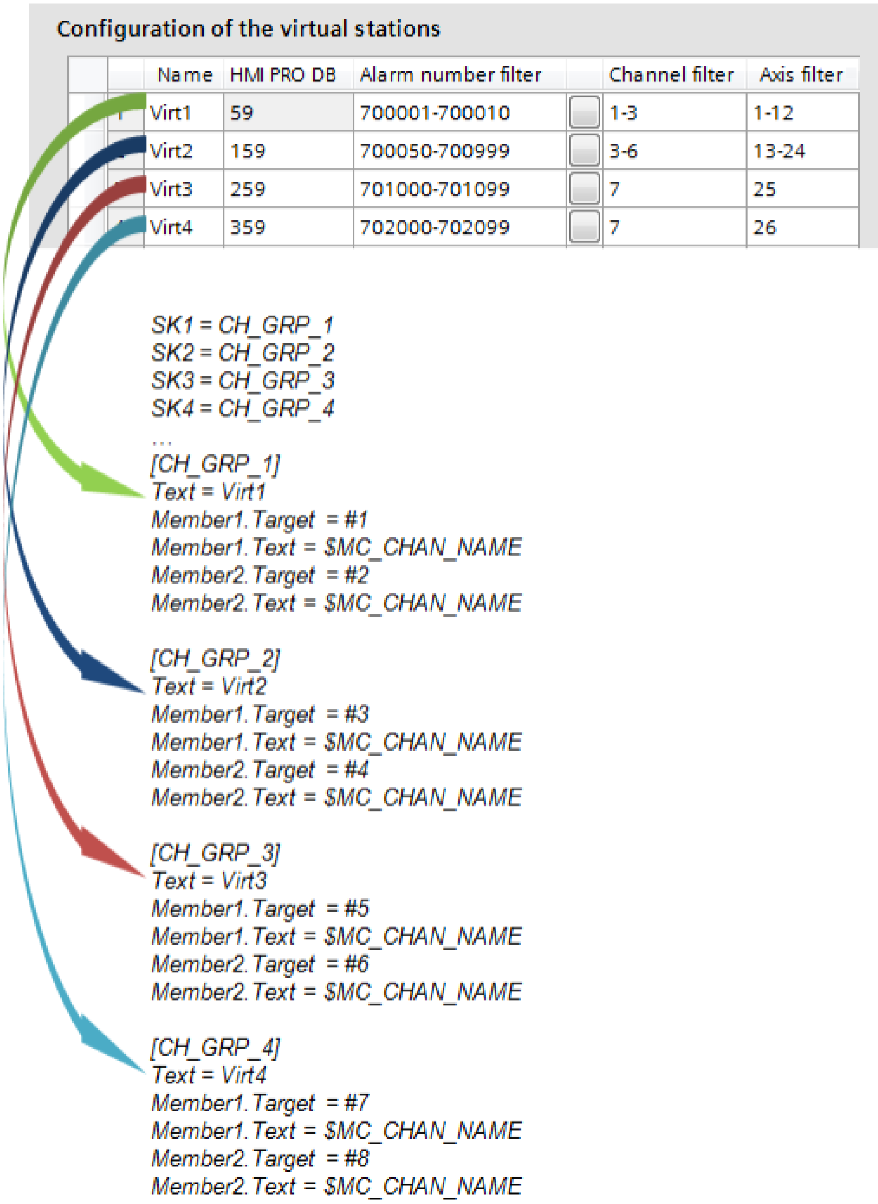


Fig. 200: Relationship between virtual stations and mode groups in HMI PRO

7.6.3 HMI PRO screen assignments

Assignment to all controls

The following screens are independent of the controller selected in HMI PRO RT, and display the data of all connected controllers:

- Alarms/messages
- Alarm analysis
- Alarm history
- Password specification by EKS

Fixed assignment to the default controller

The following screens and functions are assigned independently of the station selected in HMI PRO RT, and permanently assigned to the first station (first station configured under **Project name ▶ Control system ▶ Configuration of the virtual stations)**:

- Lamp test
- Group acknowledgment
- Selecting a screen via PLC
- Change language via PLC
- Machine utilization (total counter, parts per cycle...)
- Shift model
- Parts tracking

Configure assignment in the function key screen

All other screens can be assigned via the function key assignment of a virtual station. The assignment is made within HMI PRO CS in the function key assignment.

Configuration and data variable (from active station)

The screen is configured separately for each virtual station, i.e. each virtual station has its own texts and its own data areas. The screen must be configured for each virtual station (VS1, VS2, VS3, V4 in the example below).

Configuration static (ROOT) and data variable (from active control/station)

The screen texts are only configured once in the root. Each virtual station has its own data areas.

Configuration and data static from control X / Station X

The screen is configured for the specified station (VS1 in the example)

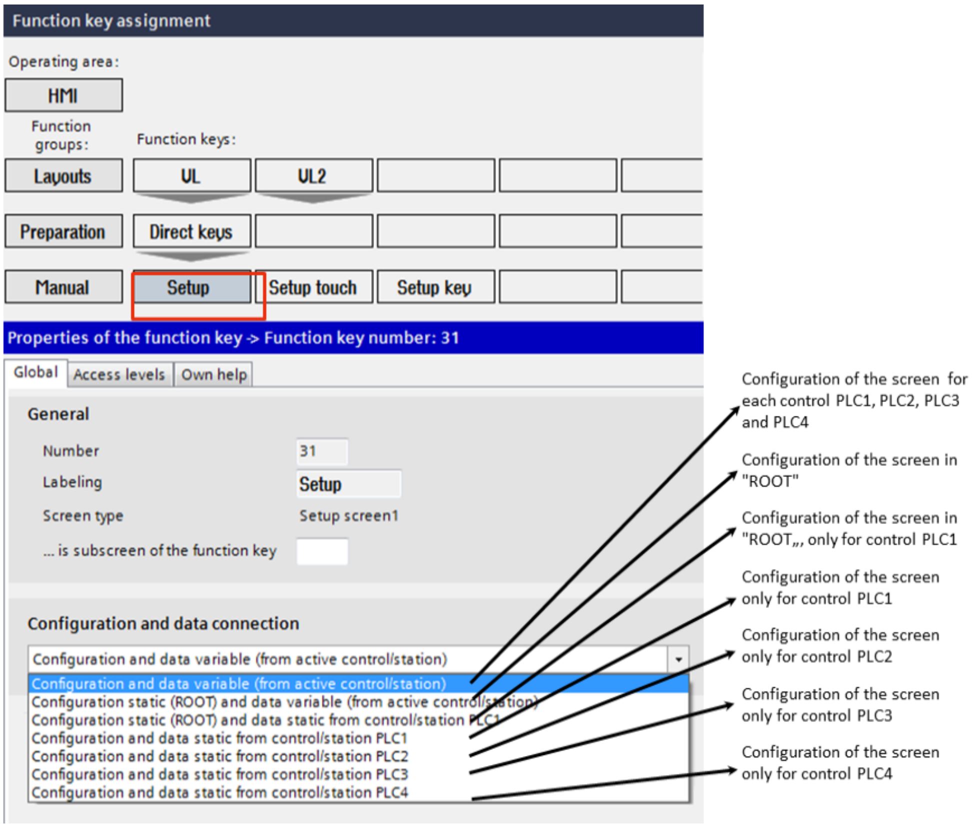


Fig. 201: Possible configurations of the station texts in the function key menu

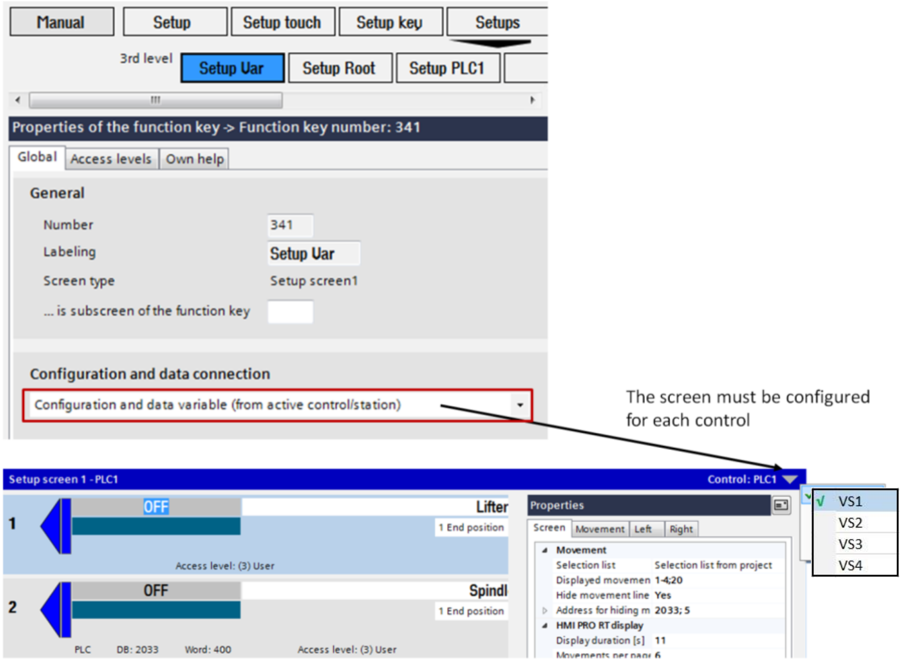


Fig. 202: Configuration and data variable as exemplified by setup screen 1

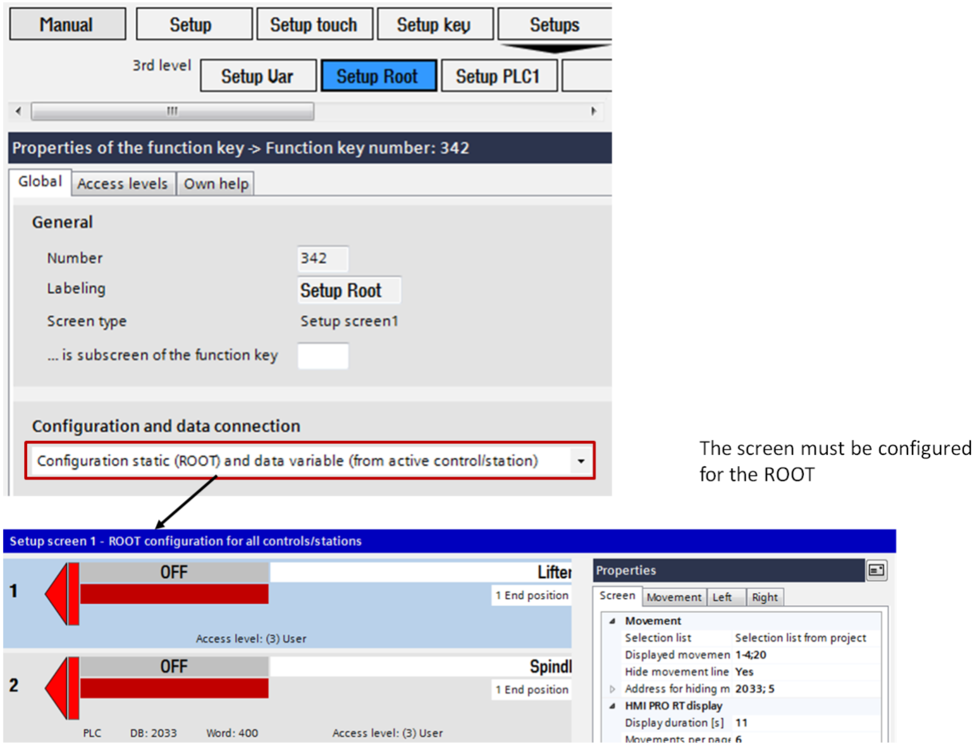
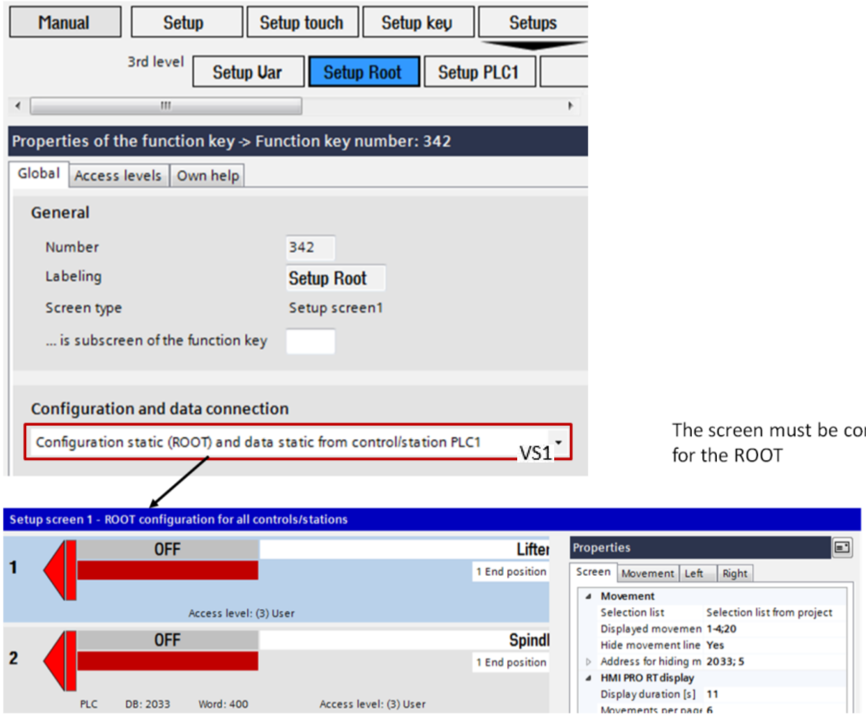
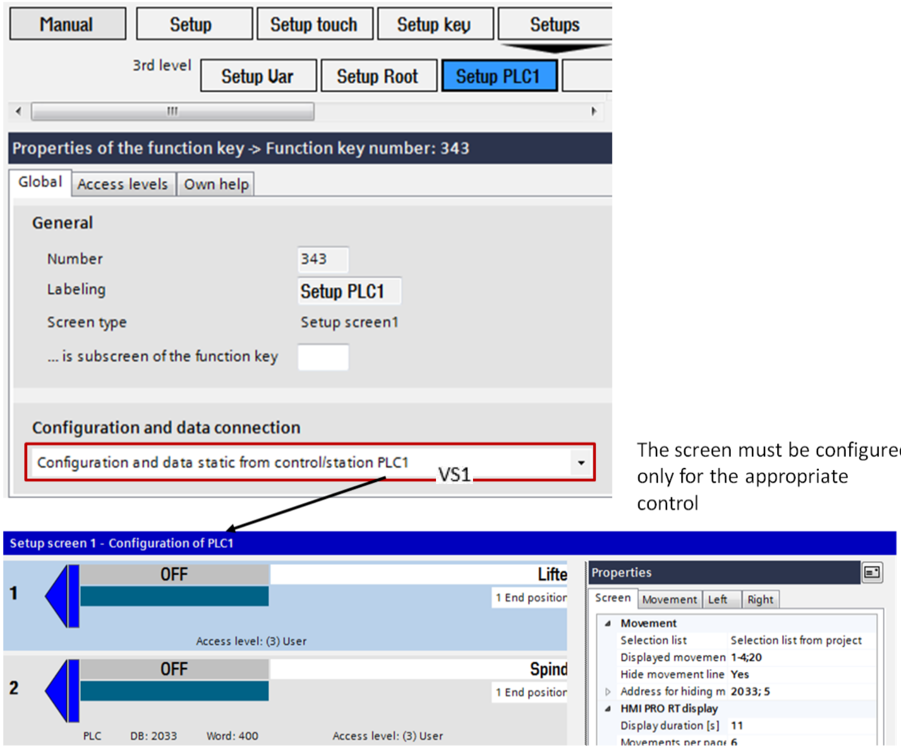


Fig. 203: Configuration static and data variable as exemplified by setup screen 1



The screen must be configured for the ROOT

Fig. 204: Configuration static and data static from station VS1 as exemplified by setup screen 1



The screen must be configured only for the appropriate control

Fig. 205: Configuration and data from station VS1 as exemplified by setup screen 1

Additional HMI PRO screens

For additional HMI-PRO screens, **configuration static (ROOT) and data variable (from the active station)** should always be set.

Creating a project with virtual stations from a standard project (1:1 assignment)

1. Create a standard project (1:1 assignment)
2. In the project navigation, under **Control**

   ▶ Control connection ▶ Basic connection, select check box Project with virtual stations (separate DBs).
3. Under **Control ▶ Configuration of the virtual stations**

   configure all HMI PRO DBs that you wish to use in your project with virtual stations.

   Your project with virtual stations is created, and the standard project that you created in step 1, is accepted as ROOT configuration and is copied to all station-specific configurations.

   The field **Configuration and data connection** is displayed in the window **Properties of the function key** under the **Global** tab.
4. To configure the virtual stations, click on the required function keys one after the other, and then copy these to a free

   function key.
5. In dialog box **Assignment function key 'Screen name',** select the

   configuration and data connection for the copied screen; i.e. which configuration and which data will be displayed after switching over to another station in HMI PRO RT.

The following configurations are available in the dialog box:

- Configuration static (ROOT) and data variable (from active station)
- Configuration and data variable (from active station)
- Configuration and data static (from station...)

If you use the controller blocks from TRANSLINE, you must ensure that the HMI-PRO DB of the currently selected station is assigned to parameter **HMI_DB**.

Configure your screens as required.

Interchanging the screen assignment in projects with virtual stations

1. Click on the required function key.
2. Copy the screen to a free function key.
3. In dialog box **Assignment function key 'Screen name',** select the

   configuration and data connection for the copied screen; i.e. which configuration and which data will be displayed after switching over to another
   station in HMI PRO RT.

   The following configurations are available in the dialog box:

- Configuration static (ROOT) and data variable (from active station)
- Configuration and data variable (from active station)
- Configuration and data static (from station...)

If you use control blocks from TRANSLINE, you must ensure that the parameter HMI_DB is assigned the number of the HMI PRO DB of the currently selected station. If required, delete the original screen.

7.7 Screens to visualize the interface between interlinked machines

The send and receive interface between machines and the linked components, such as laser, extinguishing system, loader etc. are to be visualized via the HMI PRO interface screen.

The example of a loader interface can be read about in the HMI texts on the Startup Sets supplied.

Note	The I/O assignment must be stored as a help file in PDF format.

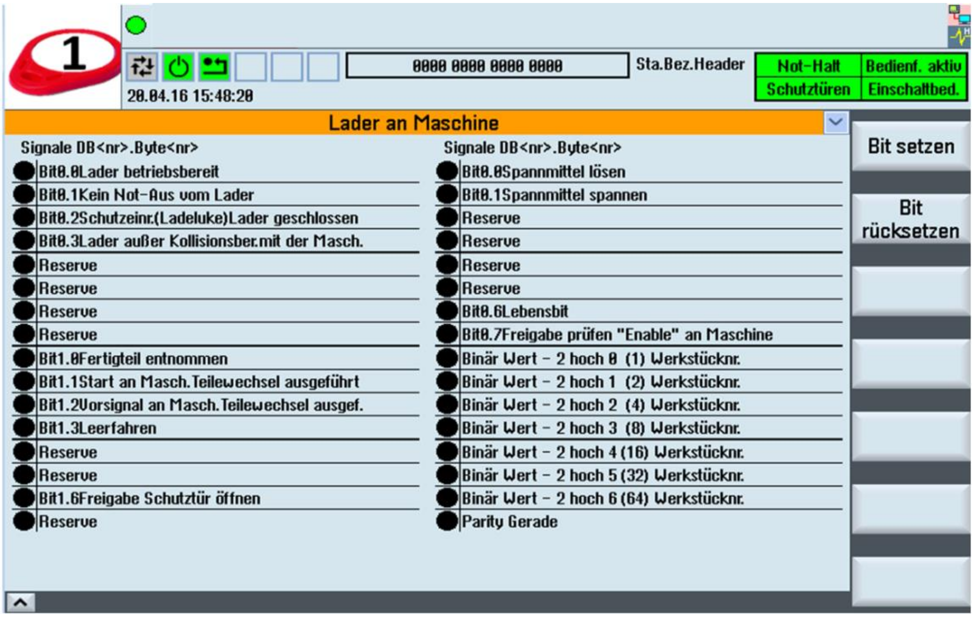


Fig. 206: Loader to machine interface screen

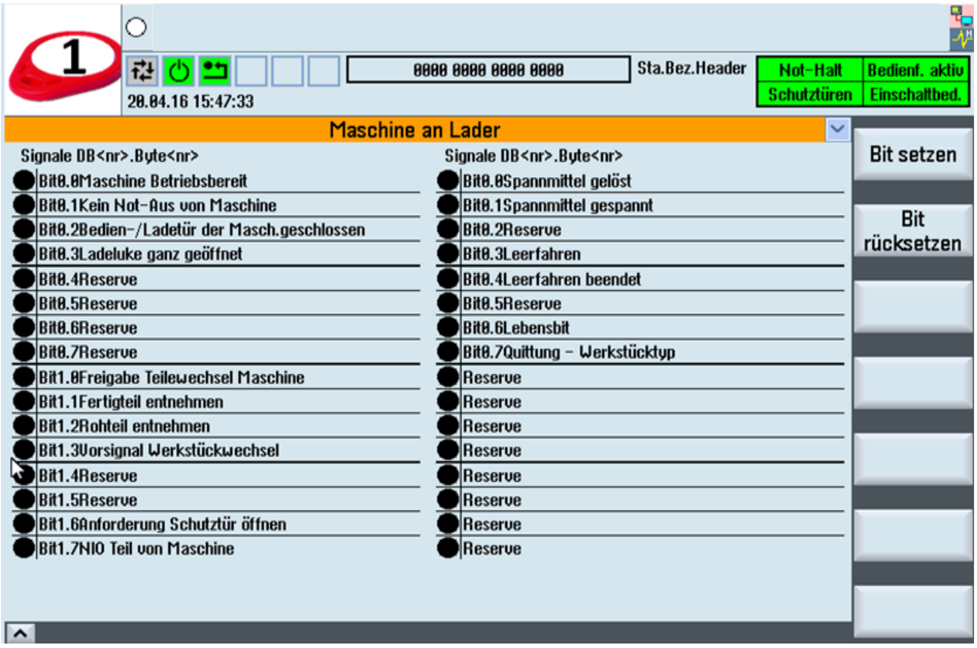


Fig. 207: Machine to loader interface screen

8 HMI Lite

If agreed with the planning department responsible, HMI Lite can be used if no PRISMA or EKS connection is required.

A description is provided in the HMI Lite manual:

https://support.industry.siemens.com/cs/ww/en/view/109760608

9 Logistics systems

The requirements for implementing logistics systems are described in the document "Control requirements for logistics systems". This document is also part of the Siemens Project Manual for Daimler Requirement Specification 2021.

PLC-controlled logistics systems are structured into the following machine types according to Requirement Specification Powertrain Part III Annex 5 Logistics systems & Conveyor technology V 2-5:

Type	Area control systems
Type 1.1	Conveyor technology, floor conveyor technology, electric monorail conveyor, Power & Free systems in the maintenance division with the exception of lifters (separately secured area)
Type 1.2	Stacker crane with car
Type 1.3	Stacker crane without car and shuttle with lifting function
Type 1.4	Shuttle without lifting function with conveyor technology (separately secured area)
Type 1.5	Shuttle without lifting function with friction roller conveyor technology (intrinsically safe)
Type 1.6	SM lifter
Type 1.7	Lifter with conveyor technology
Type 1.8	Lifters for which work by the operator is necessary, or cannot be avoided, in the vicinity of the moving vertical axis when the protective device is open.
Type 1.9	Stackers / Unstackers
Type 1.10	Robot transfer as a separate cell / island
Type 1.11	Suspended monorail in assembly area

Table 51: Types of logistics controllers

Note	FTS/FTF and conveyor technology within machines are not taken into consideration here.

10 SAFETY

10.1 PROFIsafe address types

The PROFIsafe address is used for unique addressing of F-I/Os and to protect standard addressing mechanisms such as IP addresses. A differentiation is made between uniqueness of the F-I/Os of PROFIsafe address type 1 and F-I/Os of PROFIsafe address type 2.

PROFIsafe address type 1	PROFIsafe address type 2
• The uniqueness of the PROFIsafe address is only ensured by the F-destination address • The F-destination address must be unique throughout the network and CPU. • In the safety printout, each F-destination address must be checked that it is unique through the network and CPU by checking that the F-destination address ranges of all F-CPUs do not overlap. • The F-destination address and F-source address are included in the CRC of the safety program.	• The uniqueness of the PROFIsafe address is ensured by the combination of F-source address and F-destination address. • The F-destination address must be unique CPU-wide and differ from all F-destination addresses of PROFIsafe address type 1 in the same network. • The F-source address that is used for the F-I/O of an F-CPU must be unique in the network. • The F-destination address and F-source address are included in the CRC of the safety program.

Table 52: Overview of requirements for PROFIsafe address type 1 and 2

PROFIsafe address type 1	PROFIsafe address type 2
• ET 200M • ET 200S • ET 200pro • ET 200iSP • ET 200eco • ET 200SP in Distributed Safety • SINAMICS • KTPx00F MOBILE	• S7-1200 • S7-1500 • ET 200SP • ET 200MP

Table 53: Device overview for PROFIsafe address type 1 and 2

You must ensure that every PROFIsafe address is unique.

Because plants and plant sections are ever more closely networked, much closer attention must be paid to the assignment of PROFIsafe addresses, particularly when they are configured separately from each other.

This is made easier by using F-I/Os of PROFIsafe address type 2 to handle PROFIsafe addresses. However, extra caution must be taken with mixed constellations or address type 1 constellations.

Recommendation

	Address type 1	Address type 2	
PLC	F-Destination Slot addresses	F-Source / Base addresses (CPU)*	F-Destination Slot addresses
1	10 – 19	2001	10100 - 10199
2	20 – 29	2002	10200 – 10299
3	30 – 39	2003	10300 – 10399
4	40 - 49	2004	10400 – 10499
:	:	:	:
99	990 – 999	2099	19900 – 19999

Table 54: Recommendations for assignment F-addresses

- Carefully consider possible communication relationships and network topologies at the start of the project. From this, derive measures for assigning PROFIsafe addresses with all those concerned.
- Assign separate address ranges for each of the PROFIsafe address types 1 and 2:
  - Assign a low number range to F-I/Os of PROFIsafe address type 1. You can define the permissible range for F-destination addresses of PROFIsafe address type 1 in the CPU properties.
  - Assign a high number range to F-I/Os of PROFIsafe address type 2.

- Define the F-source addresses for all F-CPUs uniquely. This will make future cross-project work and subsequent expansions easier to manage.

Further information

You will find more information on PROFIsafe address types in the Siemens Industry Online Support:

What is the difference between PROFIsafe address types 1 and 2 with respect to the uniqueness of the PROFIsafe address?

https://support.industry.siemens.com/cs/ww/en/view/109479905

How can PROFIsafe addresses be assigned in a way that will make them unique across the network and CPU?

https://support.industry.siemens.com/cs/ww/en/view/109740240

10.2 SINUMERIK – Safety Integrated

10.2.1 General description

10.2.1.1 Description

To ensure the functional safety of a machine/plant, the safety-related parts of the protection and control devices must function correctly. In addition, the systems must behave in such a way that either the plant remains in a safe state or it is put into a safe state if a fault occurs. In this case, it is necessary to use specially qualified technology that meets the requirements described in the relevant standards.

"SINUMERIK Safety Integrated" is part of this qualified technology and must be used machine-specifically in such a way that the necessary functional safety is achieved when used in combination with other protective devices for the machine (e.g. protective doors, emergency stop buttons, ...) All configuration examples and notes listed below are recommendations for appropriate implementation of SINUMERIK Safety Integrated, which must be agreed with the final customer.

10.2.1.2 Function overview

SINUMERIK Safety Integrated is a comprehensive safety package that helps to protect people as well as machines – and which is very efficient and economical thanks to the complete integration of the safety functions in the control and drive technology. Moreover, all machines and plants can be operated in a safe and secure manner under all required operating conditions (for example, in setup and test operation while the protective door is open). The safety functions meet the requirements of safety category 3 and

SIL 2 acc. to IEC 61508 and PL d acc. to DIN EN ISO 13849.

SINUMERIK Safety Integrated provides the following functions:

Basic functions

• Standstill	Safe Torque Off, Safe Operating Stop
• Shutdown	Safe Braking Ramp, Stop variants
• Speed	Safely-Limited Speed
• Safe Position	Software Limit Switch and Safe Cam

Connecting sensors and actuators

- Safety-related inputs and outputs

- Safe communication via standard bus
- Safe Programmable Logic
- Sensor/actuator connection system

The safety-related sensors and actuators are always connected in two channels. For this, either the ET 200S, ET 200eco or ET 200pro PROFIsafe I/Os, or the DP/AS-i F-link is used.

10.2.2 Interlinked systems – Basic structure

In this chapter, the basic structures of the machine concepts, transfer line and flexible production line, largely used in mechanical large series manufacturing, are explained in more detail.

10.2.2.1 Transfer lines

The design of a transfer line is characterized by single or pairs of opposite units that are connected in a mechanically rigid way via the conveying area (e.g. with a transfer bar or overhead transfer). This machine concept is based on the idea of using flexible, standard configurable components on standardized basic machines. These highly automated production plants primarily designed to meet special customer requirements and needs (customized degree of flexibility). With its flexible modular design, the transfer line can be adapted to individual machining tasks and modules can be replaced and reused as production requirements change (simple adaptation to workpiece modifications or new parts with a modular system). These standard components are, for example, 1-axis units, horizontal/vertical, 2-axis units horizontal/vertical, and 3-axis units.

Mainly NC units, but also PLC units are integrated into a transfer system. Central coordination is performed by the master control.

The master control does not necessarily have to consist of a Sinumerik 840D sl. The master control must be capable of performing safety-related signal exchange with the individual units and safe internal processing.

Access to the machining area is provided by protective doors (if necessary, with two wings) with interlocking. These machining doors are usually located on both sides of the units. Each unit can additionally be equipped with a tool change or maintenance door with interlocking.

The safety areas of a transfer line consist of a higher-level safety area (transfer line as a whole) and the individual safety areas of the units. The emergency stop concept of a transfer line is conventional, i.e. in an emergency stop case of a unit/master control, the whole plant is put into a safe state (rigid coupling □□full shutdown).

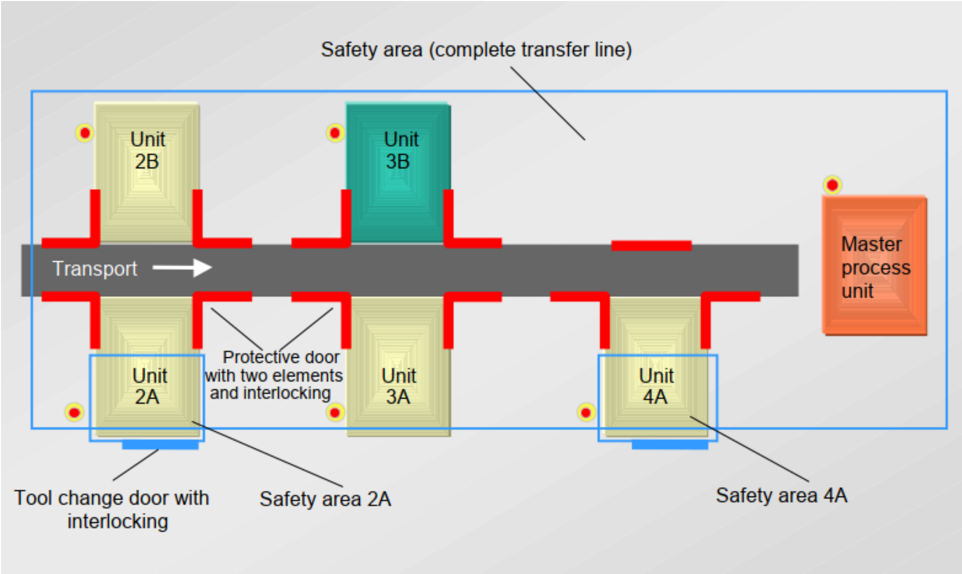


Fig. 208: SAFETY Integrated – Transfer line

Additional features / Constraints on the plant structure of a transfer line

If exclusively PLC functionality is required for a unit, a fail-safe automation system can be established with a SIMATIC S7-300F CPU or 1500F. With this controller system, safety-related communication can be implemented by means of PROFIBUS DP or PROFINET with PROFIsafe profile, with distributed I/Os from the ET 200S, ET 200eco, ET 200pro and ET200sp series.

Using the function "ASIsafe", signals can be collected at the machine and distributed simple disconnection implemented.

Connection with other units or to the master unit is implemented with a bus link.

10.2.2.2 Flexible production line

The flexible production line is characterized by a combination of individual "standalone" machining centers with equipment for handling and conveying workpieces (loaders/gantries). Depending on the requirements, special-purpose machines or additional equipment can be integrated. Depending on the modular design of the overall concept, the flexible production line can be adapted to customer requirements (depending on the organizational strategy, e.g. further processing, complete machining) and provides potential for expansion in the future. This machine structure is characterized by a high degree of availability, i.e. individual units can be removed from the automation network in case of a fault (machine fault, maintenance), while the overall linked configuration continues production.

The design of machining centers is characterized by a horizontal spindle and axis types with a high dynamic response.

Mainly NC units, but also PLC units are integrated into a flexible production line grouping. The central coordination of the safety functions can be performed by the master control, alternatively management of the safety functions can be distributed between the stations.

Access to the machining area is provided by a protective door (and possibly, a second lateral protective door) with interlock. The individual machining centers are loaded through a loading hatch. The safety concept should include a consideration of the impact strength of the loading hatch. For maintenance tasks, every machining center should be equipped with a maintenance door and possibly a tool change door with interlock.

The safety zones are flexible, i.e. depending on which protective device is open (e.g. loading hatch or protective door(s)), a different safety zone might apply (multiple individual safety areas are coupled via an open protection device). A central aspect of configuration is therefore clarifying how the individual safety zones are coupled with one another and what responses are to be derived from that. A typical example is the emergency stop strategy, i.e. the effect of an emergency stop pushbutton could be dependent on the currently active safety zone.

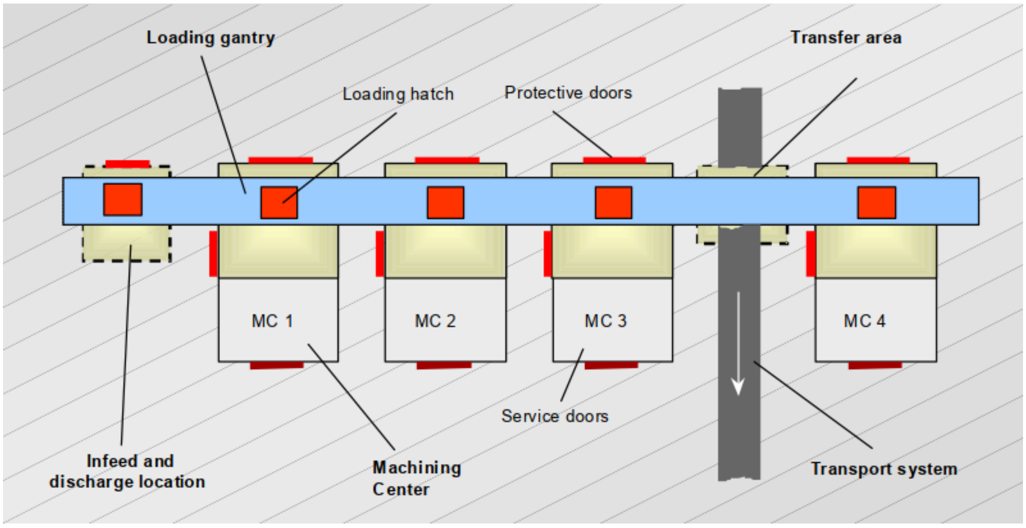


Fig. 209: SAFETY Integrated - Flexible production line

10.2.3 Sinumerik Safety Integrated with standalone machines

A standalone machine is a machine unit that is controlled by no more than one CNC/drive unit. Used with SINUMERIK Safety Integrated, this CNC/drive unit provides safety functions that, in combination with other protective equipment on the machine (e.g. protective doors, emergency stop pushbutton, ...), results in the necessary functional safety.

The safety functions and protective equipment is used on the machine and their effect is described in a function table for that purpose. This table is part of the SI configuration, which is supplied as a standard form.

10.2.4 Sinumerik Safety Integrated with linked systems

A linked system is the coupling of multiple machine units (transfer line, flexible production line), each of which is controlled separately by a CNC/drive unit or a PLC unit.

The safety-related signals are transmitted via PROFIBUS or PROFINET.

Depending on the SINUMERIK version, up to sixteen safe connections can be configured. If more than sixteen safe connections are required, safe communication can be implemented by means of a SIMATIC F-controller.

In safety-related CPU-CPU communication for plant coupling, a fixed number of failsafe data is transferred between the safety programs in the F-CPUs. Data transfer is implemented using the F_SEND function for sending and F_RECV for receiving.

On SIMATIC controllers, this must be parameterized in handling blocks and on SINUMERIK controls in machine data.

Safe communication is possible both with PROFIBUS and with PROFINET.

Further information is provided in "SINUMERIK Safety Integrated" Description of functions.

10.2.4.1 Plant structure with Sinumerik 840D sl:

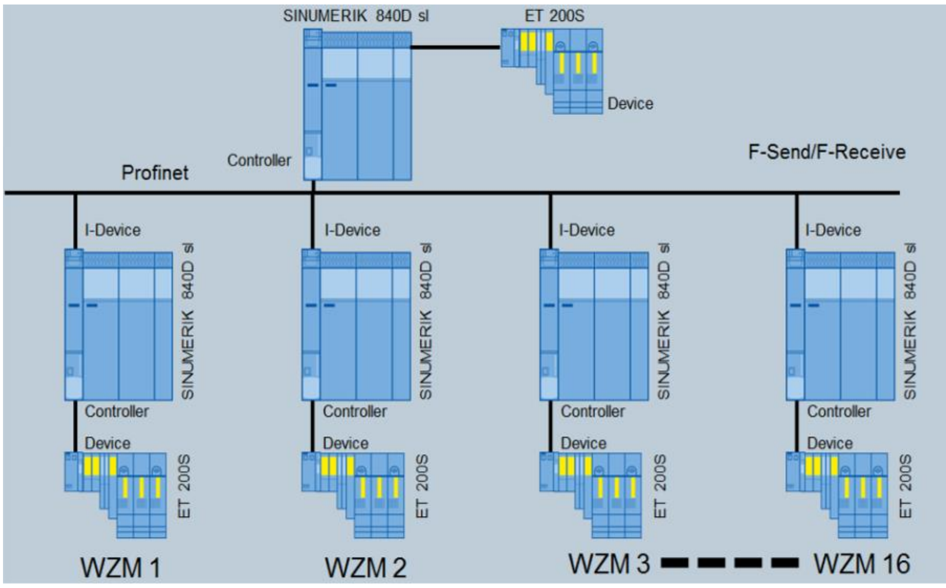


Fig. 210: I-Device coupling SINUMERIK

Communication is possible both between the master control and the machine tool and between the individual machine tools.

A master/master link can be used whenever machines of different machine manufacturers have to be linked with each other. In this case, each machine manufacturer can create its own STEP 7 project.

10.2.5 Coupling concept for transfer lines

Possible signal flow of a transfer line:

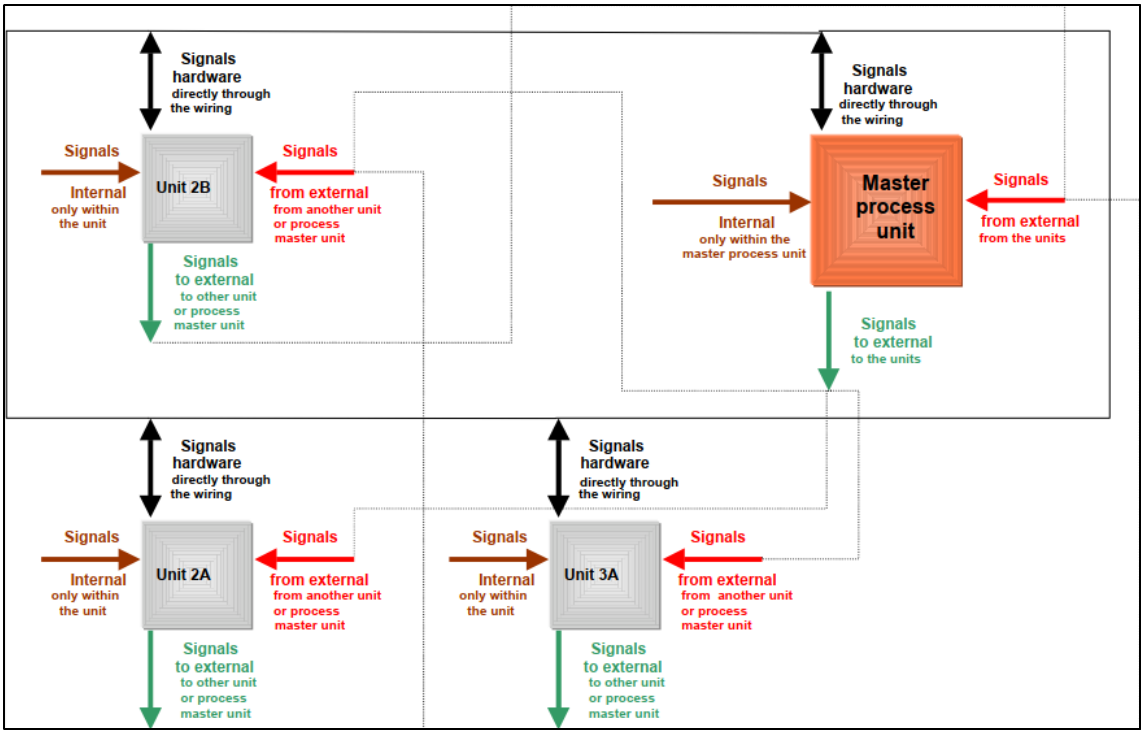


Fig. 211: SAFETY Integrated – Example of a transfer line

10.2.5.1 General conditions for the description of the coupling concept

The descriptions below do not discuss every possible transfer line structure that can occur but look at "basic types" of transfer lines to which the following constraints apply:

- The features described under 2.1 apply.
- In the case of a single unit, we distinguish between a PLC unit (the functions of the unit are pure PLC functions) and an NC unit (the functions of the units are both NC functions and PLC functions).
- In general, one unit has two protective doors and two protective door groups, which can be viewed as a single entity:
    - Protective door (group) 1: Access to workspace of the unit and conveying unit
    - Protective door (group) 2: Access to tool change area of the unit (also for maintenance purposes)
- Depending on the machining step and mechanical coupling, opposite units can form a dual unit (a shared safety zone) within which safety-related signal exchange between the two individual units can take place.

- The conveyor drive can either by hydraulic with the states "ON/OFF" or NC controlled. If the conveyor drive is NC controlled, the following operating states are possible in combination with the function SINUMERIK Safety Integrated: no monitoring active, monitoring for safe speed (SG/SSM) active, monitoring for safe operating stop (SBH/SOS) active, safe pulse suppression in the drive (SH/STO).
- Because central coordination and control of the conveyor unit is performed by the master control, safety-related coupling is only possible if safety-related signals are processed internally via the master control and can be transferred to the units.

10.2.5.2 Safety zones

A distinction is made between two types of safety zone:

- Safety zone of the unit or dual unit. The safety zone of the unit is opened by both protective doors (groups). Depending on the configuration and interaction of the unit, opposite units form a shared safety zone. If only the maintenance or tool change door of the unit is open, the conveyor unit and the other units are not affected.
- Total safety zone of the transfer line

  As a rule, the protective door(s) to the working area of the unit also provide access to the conveyor unit, i.e. in addition to the actual machining axes of the unit, the conveyor unit and other units, via a possible feedback signal to them, are also affected. Along a transfer line, there can be several slots for a handheld device with acknowledgment button with which the conveying axis can be traversed in acknowledgment mode (e.g. when the protective door of a unit is open). Activation of acknowledgment mode can also depend on the position at which the total safety zone (i.e. on which unit) was opened (e.g. depending on visibility of the conveying axis).

10.2.5.3 Example of the signal flow for a unit

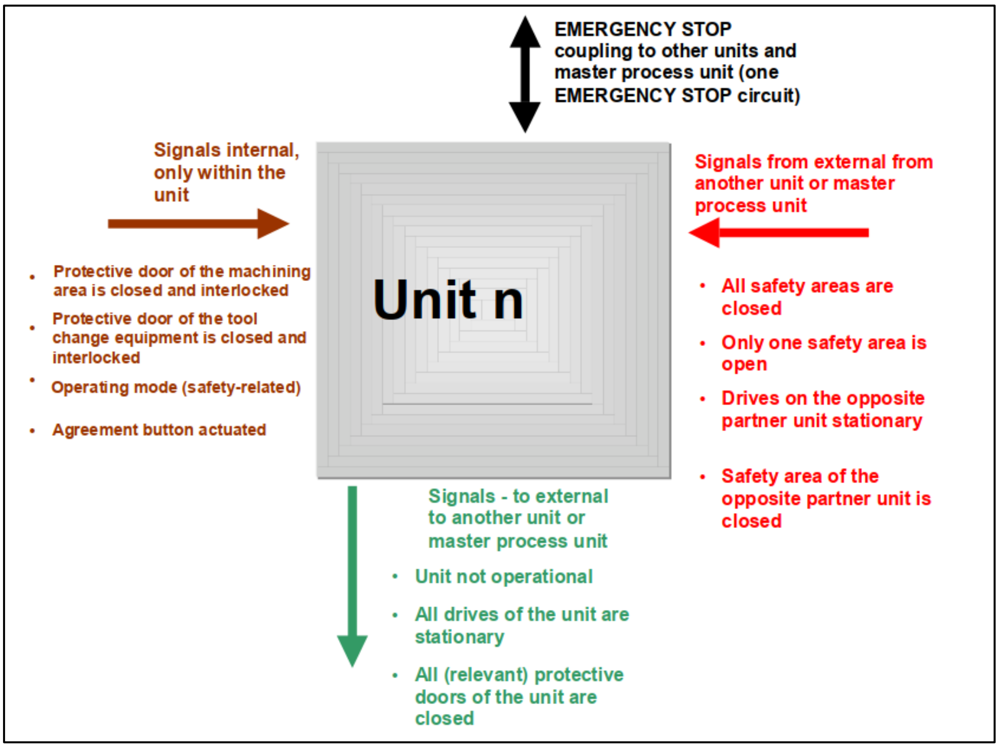


Fig. 212: SAFETY Integrated – Example of the signal flow of unit

Note	The signal description and the function description for it is not generally applicable but is an example only and is provided as conceptual support for configuration of the safety functions.

Units – internal signals

- Protective door (group) working area (+ conveying) closed and interlocked. Depending on this signal setting, a monitoring function is activated for each of the axes assigned to the working area, e.g. SBH/SOS when the working area is open. The status of this signal is also significant outside the unit (see below).
- Protective door (group) tool change closed and interlocked: Depending on this signal setting, a monitoring function is activated for each of the assigned axes, e.g. SBH/SOS when the working area is open. The status of this signal is only significant inside the unit.
- Operating mode (safety-related), see Chapter 7

  A distinction is made between four machine operating modes:
  - Setup mode SET
  - Single step mode SSM
  - Single mode SM
  - Automatic mode AUT
- However, a distinction is only made between two safety-related operating modes:

  - The safety-related operating mode "PRODUCTION" corresponds to the machine operating modes SSM, SM, and AUT.
  - The safety-related operating mode "SETUP" corresponds to the machine operating mode SET.
- Acknowledgment button pressed

  Only effective, for example, in operating mode "SETUP". When the acknowledgment button is pressed, travel with safely reduced speed (SG/SSM) when the protective door(s) are open is possible.

Signals to external (other units or master control)

For signal exchange between two communication partners, the variants described in Chapters 4.2 and 4.3 apply.

- All (relevant) protective doors of the unit are closed: This signal indicates that the "unit" safety zone is closed and access to the conveyor unit is not possible. This signal can either be transmitted directly to the master control (in the case of a single unit) or to the opposite partner unit (in the case of a dual unit), and is then transmitted via the latter to the master control.
- Unit is out of service: This signal can communicate to the master control that the unit is not being used for the current machining process and the other signals of the unit (e.g. protective doors) are not considered or are considered in a different way by the master control in safety terms, e.g. a switched-off unit (main switch) can also be handled in the correct manner by these means.
- All drives of the unit are at standstill (e.g. group signal from safety-related output signal n<nx or SBH active across all axes). This signal may be relevant for the opposite partner unit if the safety zones of the two units are currently coupled and a request to open the protective doors is pending for the partner unit.

Signals from external (other units and master control)

For signal exchange between two communication partners, the variants described in Chapters 4.2 and 4.3 apply.

- All safety zones are closed:

  If all safety zones are closed, there are not traversing restrictions for the axes of the unit and of the conveyor unit.
- Only one safety zone is open:

  As long as only one safety zone (e.g. one unit incl. access to conveyor unit) is open, acknowledgment mode can be activated. In this way, it may be possible to suppress opening of a second unit.
- The drives on the opposite partner unit are stationary:

  The explanation above for signal "All drives of the unit are at standstill" applies.
- The safety zone of the opposite partner unit is closed:

  The safety zones of partner units can be coupled. In this case, the information as to whether one or the other unit is closed or not closed must be exchanged between the two units.

10.2.5.4 Emergency stop concept

The coupling of the emergency stop function between units or with the master control is implemented with the function F-SEND/F-RECEIVE via PROFIBUS or PROFINET. There is usually one emergency stop circuit in which all emergency stop actuators in the system have equal priority, i.e. if emergency stop is issued, all units are switched off.

10.2.5.5 Forced checking procedure

According to the emergency stop concept described above, no test steps are required that affect the entire plant, i.e. the test steps are performed in a decentralized way for each unit and the master control subject to the following constraints:

- The routine for the forced checking procedure usually comprises the following test steps:
  - Test the brake control (if necessary)
  - Test the brake mechanism (if necessary)
  - Testing the switch-off signal paths
  - Test the external stops (if used)
- The forced checking procedure may be performed isochronously for all units. In this case synchronization is performed via the master control
- If an error is detected during the forced checking procedure, a response can be triggered via a (non-safety-related) feedback signal in the master control or other units.

10.2.6 Coupling concept with flexible production lines

10.2.6.1 General conditions for the description of the coupling concept

The descriptions below do not discuss every possible structure of a flexible production line that can occur but look at "basic types" of such a production line to which the following constraints apply:

- The features described under 2.2 apply.
- Every **machining center** is essentially an autonomous unit, which is operated independently of the environment and which can also be defined in safety terms.
- There is no generally applicable safety-related coupling concept for the flexible production line. Besides pure safety aspects (which are evaluated as part of a risk analysis), the operating concept also has a strong influence on the coupling.
- The individual machining centers are coupled with a **loading system**. The type of coupling, i.e. the workpiece feed, has a decisive influence on the safety functions to be implemented. For workpiece feed, the/a safety zone of the previously autonomous machining center is coupled with the safety zone of the loading system. Prior safety disconnection is only valid if the disconnection is performed by a component (e.g. of a loading hatch) of adequate mechanical design (e.g. impact strength).

10.2.6.2 Safety zones

Different safety zones are available depending on how the machining center is connected to the loading system

Loading via loading hatch in the working area

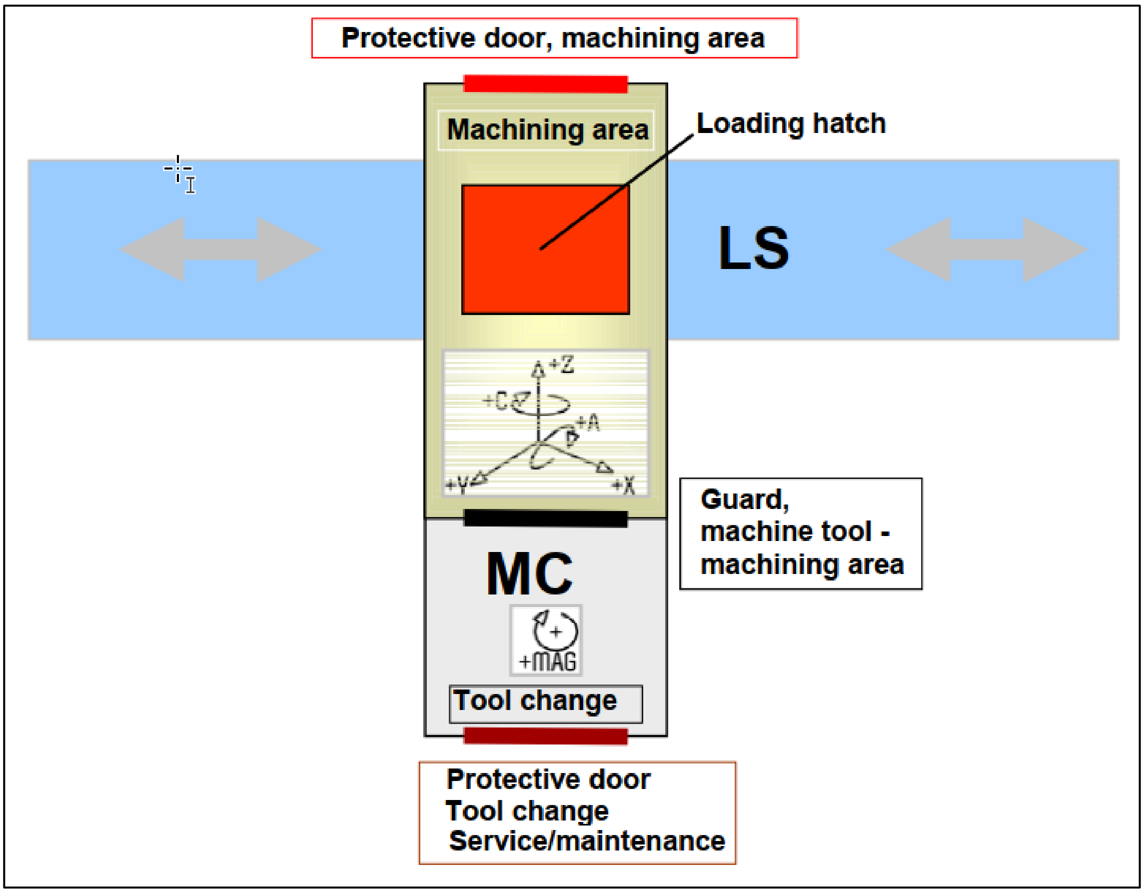


Fig. 213: Safety zones (loading hatch in the working area)

<u>Characteristics (safety zones)</u>

- The machining center already comprises two safety zones if disconnection between the tool change area and the working area is implemented in a safety-related way via the separation flap (i.e. acquired in two channels). When the separation flap is open, the two safety zones are interconnected so that the same monitoring function is applied to all axes assigned to the working area as for the axes of the tool change area.
- The safety-related coupling of the safety zones of the machining center and loading system is implemented via the loading hatch which is also acquired in two channels. When the loading hatch is open, the two safety areas machining center and working area (possibly also tool change area) are coupled with one another and interact.

Loading via loading hatch in a separate loading area

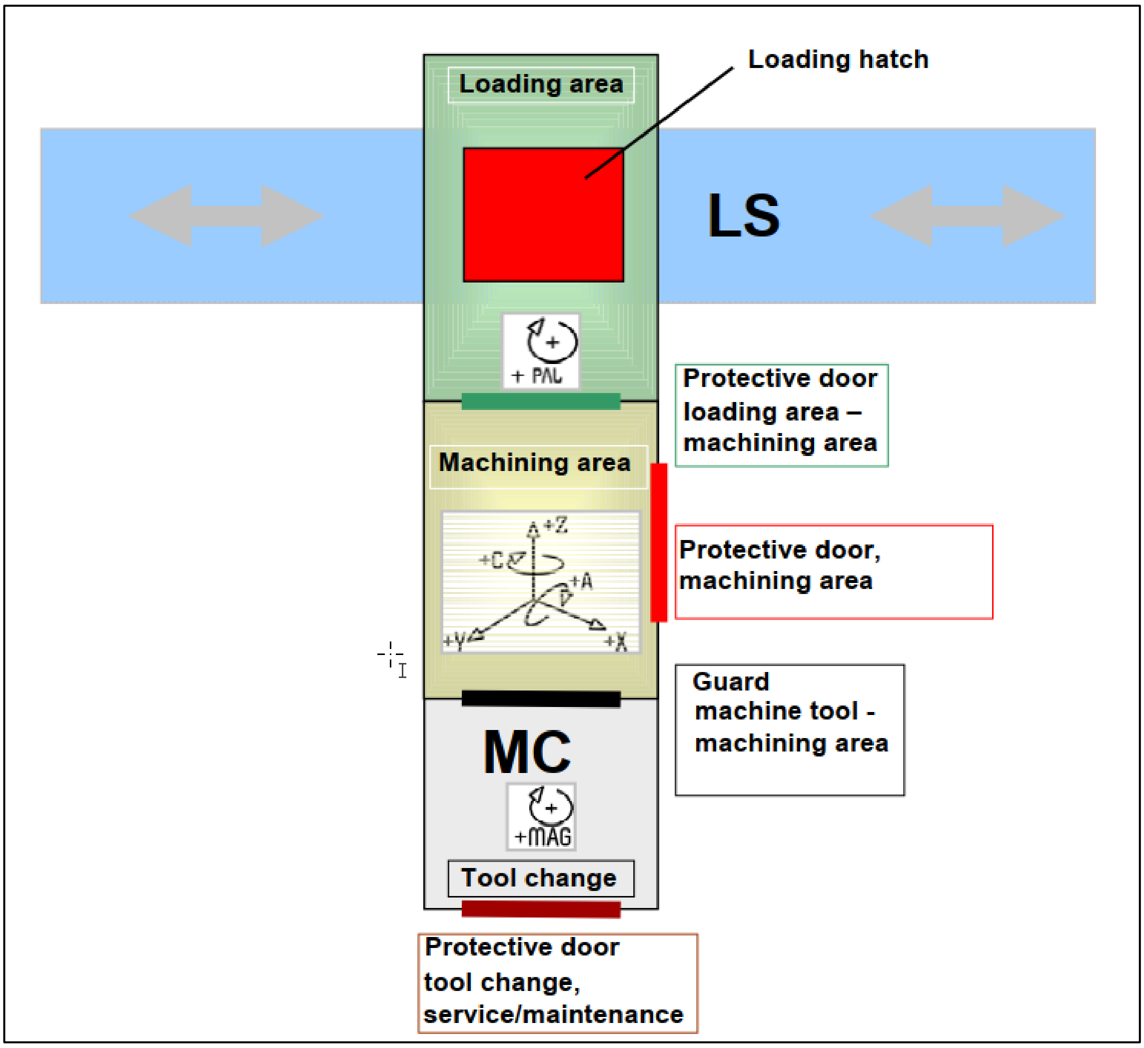


Fig. 214: Safety zones (loading hatch in a separate loading area)

<u>Characteristics (safety zones)</u>

- The machining center already comprises three safety zones if disconnection between the tool change area and the working area and the disconnection between the loading area and the working area is implemented in a safety-related way (i.e. acquired in two channels). Thus the axes of the machining center are assigned to these different safety zones.
- The safety-related coupling of the safety zones of the machining center and loading system is implemented via the loading hatch which is also acquired in two channels. When the loading hatch is open, the safety areas loading system and loading area (possibly also working area and tool change area) are coupled with one another and interact.
- If, in this coupling, the loading area is disconnected from the working area, loading can be performed independently of the actual machining in the working area because the safety zones in question are not coupled with each other.
- This constellation also permits simple "STANDALONE" operation of the machining center, independently of the loading system, because as long

as the dividing door between the loading area and working area is closed, the working area safety zone and the loading system are not coupled.

Further safety zones

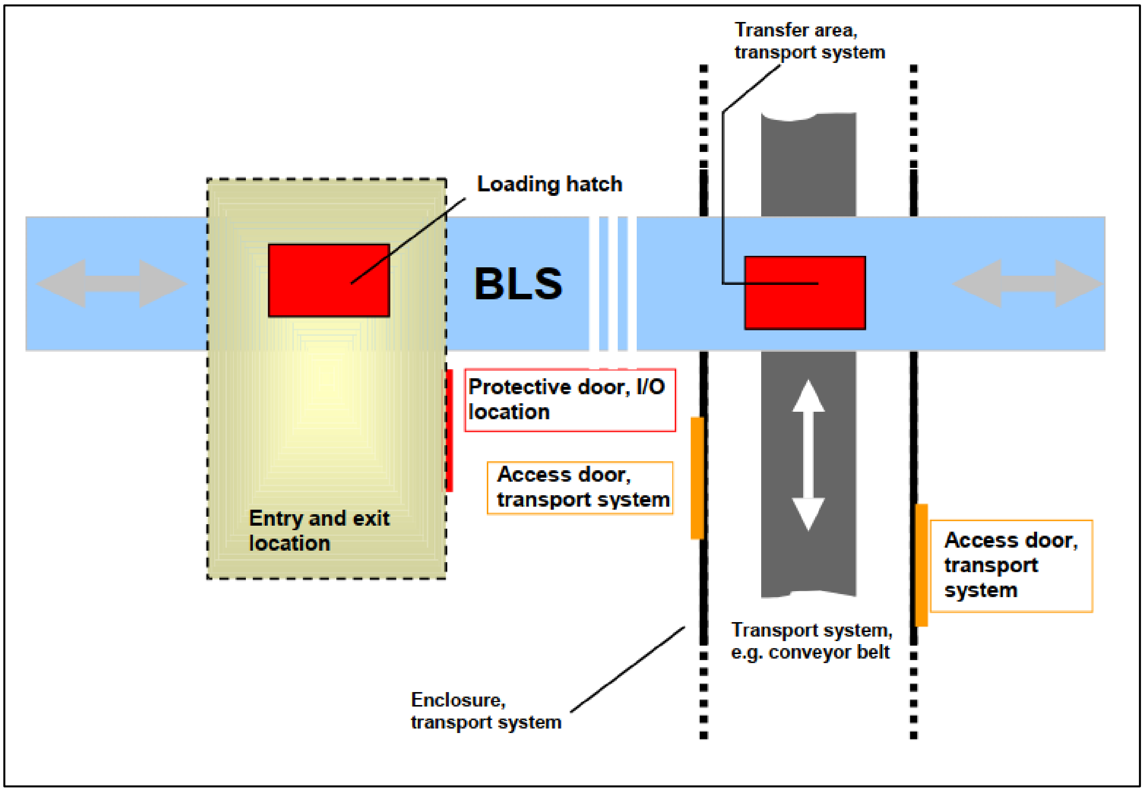


Fig. 215: Further safety zones

Entry and discharge point:

- The entry and discharge point is a separate safety zone with its own access (the entry/discharge point protective door must be acquired in a safety-related way).
- The safety-related coupling of the safety zones of the entry/discharge point and loading system is implemented via the loading hatch which is also acquired in two channels. When the loading hatch is open, the safety areas machining center and entry/discharge point are coupled with one another and interact.

Connection to the conveyor system

- As a rule, the conveyor system and loading system safety zones are not separated from each other by a loading hatch or similar equipment. This means that if an access door to the conveyor system is opened (which must be acquired in a safety-related way), the loading system is directly affected because it is the same safety zone.
- The coupling of the conveyor system and loading system safety zones is then performed irrespective of whether the conveyor system control is performed by the loading system control or its own control.

10.2.6.3 Coupling variants of a bus link

Safety-related communication between two SINUMERIK 840D sl or between one SIMATIC F-CPU and one SINUMERIK 840D sl is performed via PROFIBUS or PROFINET with the function F-SEND/F-RECEIVE.

Up to 16 communication connections can be parameterized with one SINUMERIK 840D sl.

If more than 16 communication connections are required, this can be implemented with a SIMATIC F-CPU.

See Chapter 4 for possible variants for a safe bus link.

For more information, see Description of Functions "SINUMERIK Safety Integrated".

10.2.7 Safety-related operator controls

The correct selection of safety-related operator controls is decisive to achieving high functional safety of the plant. Connection of the safety-related operator controls must be implemented in two channels.

This applies, for example, to:

- Emergency stop button
- Protective door switch
- Operating mode selection
- Acknowledgment button

Emergency stop buttons are used by pushbutton panels, HHUs or HT8.

The HHU and the HT8 also have a two-channel (4-wire) acknowledgment button. Allowing them to be cross-circuit monitored.

Operating mode selection (at least the safety-related modes "SETUP" and "PRODUCTION") must also be implemented in two channels.

This can be clearly defined specifically for each project (in a description of differences).

10.2.7.1 Integration of switching signals with synchronously switching contacts

On various safe switching elements, two switching contacts can be switched asynchronously (e.g acknowledgment button of the HT8). This can result in error messages in SINUMERIK Safety Integrated if the defined discrepancy time is exceeded. To avoid these error messages, a solution is available, which is described below:

If, with SINUMERIK Safety Integrated, different signal states of the individual channels are ascertained on safe two-channel sensors, the data and result cross-check shuts down the drives with Stop D after a defined discrepancy time has elapsed. This is the correct and intended response of Safety Integrated.

In the case of the acknowledgment buttons of the HT 2 and HT 8, depending on how the pushbutton is operated, only one of the contacts might close due to mechanical imprecision. So it might be that shutting down the drives is not wanted or might even disrupt the work process.

If the acknowledgment button is connected via the PROFIsafe I/Os of the ET200SP, the solutions offered below describe methods for preventing premature or general shutdown due to a data and result cross-check.

1) Adapting the properties (discrepancy response, discrepancy time, reintegration) of the F-DI module in the Step 7 HW Config

If a safety-related two-channel sensors is connected to an F-DI module (2v2 evaluation), the discrepancy response can be set in the HW Config of Step7 in the module properties.

This error response can be almost completely suppressed with the settings for discrepancy response, discrepancy time, and reintegration without compromises on safety.

Discrepancy behavior

Here, select response "Supply value 0".

With the setting "Supply value 0", in the case of a discrepancy the input for the SPL program will immediately be set to status "0". The discrepancy time is not allowed to elapse.

Discrepancy time

The max. possible discrepancy time of 30000ms must be entered.

The discrepancy time is started if two associated input signals are found to display different levels. The program checks whether there are differences in the input signals for a parameterizable time period. If this is the case, there is a discrepancy error.

This means the different signal states of the two contacts would, in an extreme case, result in a discrepancy error only after 30s and cause the drive to stop.

Reintegration after discrepancy error

Here, "Test 0-Signal necessary" must be selected.

By selecting "Test 0-Signal necessary", the discrepancy error cannot be acknowledged until both input signals have status 0.

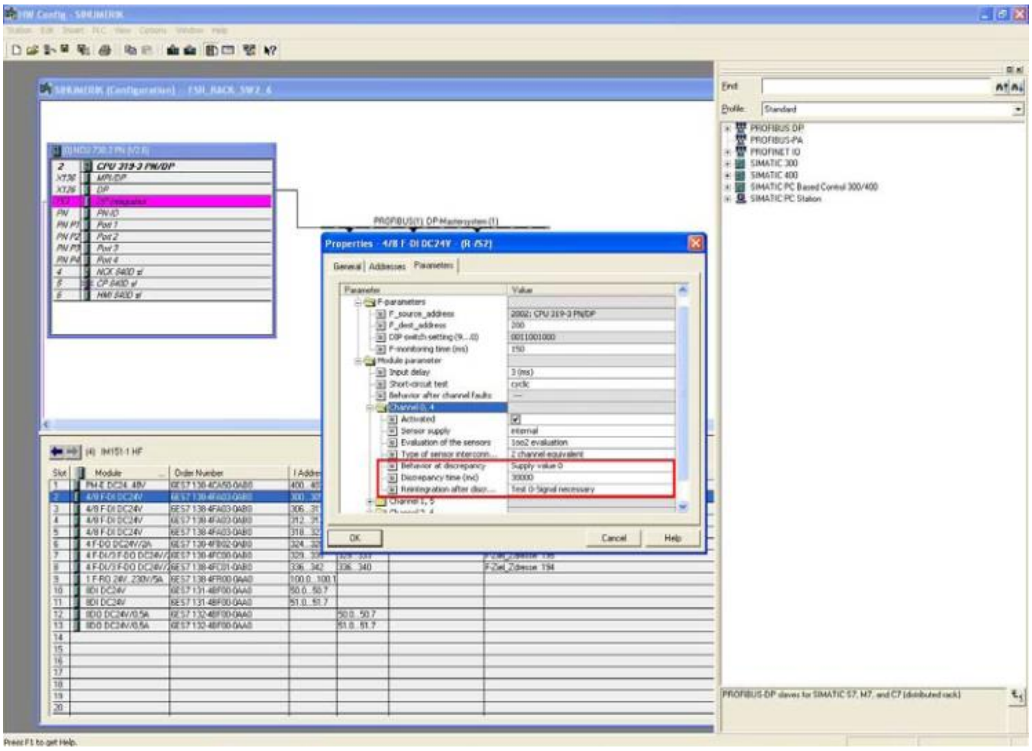


Fig. 216: SAFETY Integrated – Reintegration after discrepancy error

The different signal state on the input module are detected during the discrepancy time but this has no effect on the SPL program.

2) 1oo1 evaluation with output of an error message

In 1oo1 evaluation, both signals of the acknowledgment button are evaluated separately. There is no discrepancy comparison of the inputs by the F-DI module as in 2oo2 evaluation. To meet the demands of safety-related solution, the discrepancy comparison must be performed and the input signals combined in the SPL logic. With this solution, machine-specific response to different input signals is possible and, for example, an error message can be output. No internal system response occurs.

Remark:

1oo1 evaluation is not possible with a mixed I/O module (4 F-DI/3 F-DO)!

Description of an application example solution:

The two channels of the acknowledgment button are separately read into the SPL (INSE(P)[50], INSE(P)[51]).

The time for the discrepancy comparison can be programmed variably ($A_TIMERSI[], Timer).

In the NCK-SPL, the result for the correctly switched acknowledgment button of $A_PLCSIOUT[2] is used, in the PLC-SPL, M112.0.

In the NCK-SPL, the PLC is also evaluated to avoid problems with pulses that are not detected by the PLC.

A start command is only output if both inputs have state=1 and any previous pending discrepancy error is acknowledged.

If a signal returns to state=0, the start command is immediately canceled.

A pending discrepancy error is automatically acknowledged if both inputs have state=0. A new start command can now be issued.

If a discrepancy error is detected, an error signal is output by the PLC; the response to the discrepancy error can be adapted machine-specifically and, for example, an ext. stop triggered by the SPL program.

After the error signal has been output, it should be checked whether the acknowledgment button has triggered an error signal because of a mechanical imprecision or whether one of the two contacts is "sticking".

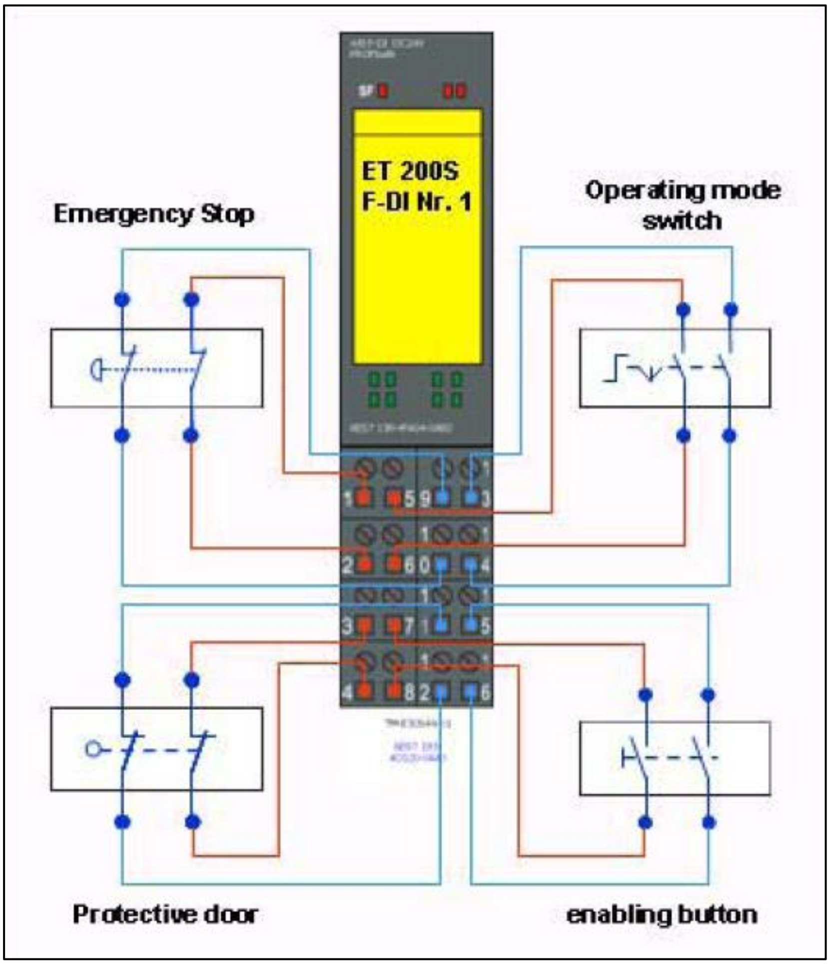


Fig. 217: Wiring example for ET200s

Settings Step7 HW Config

A 1oo1 evaluation is selected in the HW Config for the inputs in question. This can be selected channel-specifically.

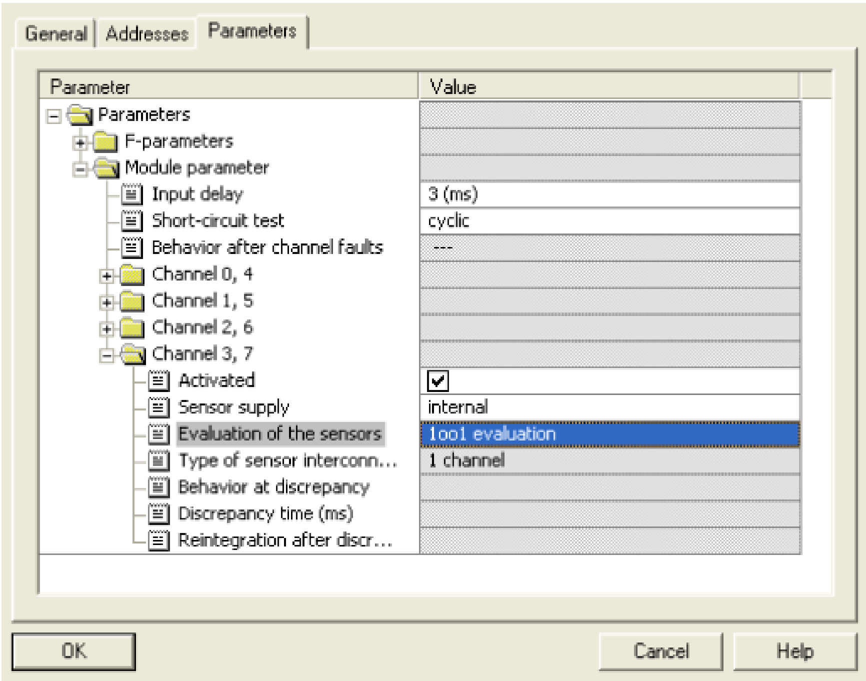


Fig. 218: Properties Parameter assignment 4/8 F-DI

```
NCK-SPL

DEFINE IE50_ACKN_CHANAL_1 AS $A_INSE[50]
DEFINE IE51_ACKN_CHANAL_2 AS $A_INSE[51]
DEFINE MI50_ACKN_CRC AS $A_MARKERSI[50]
DEFINE TIMER1 AS $A_TIMERSI[1]
DEFINE PI11_PLC_error AS $A_PLCSIIN[11]
DEFINE PO01_ANCK_ERROR AS $A_PLCSIOUT[1]
DEFINE PO02_ANCK_OK AS $A_PLCSIOUT[2]

; Acknowledgment button 1oo1 evaluation

; Acknowledgment ok
ids=100 do PO02_ANCK_OK = IE50_ACKN_CHANAL_1 and
IE51_ACKN_CHANAL_2 and not PO01_ANCK_ERROR and not PI11_PLC_error

; Evaluation data cross-check acknowledgment button
ids=101 do MI50_ACKN_CRC = IE50_ACKN_CHANAL_1 xor
IE51_ACKN_CHANAL_2

; Evaluation data cross-check > 2 sec
```

```
ids=102 every MI50_ACKN_CRC==0 do TIMER1=0 TIMER1=-1

SAFETY

ids=104 every MI50_ACKN_CRC==1 do TIMER1=0
ids=105 every (TIMER1>2.0) do PO01_ANCK_ERROR=1 TIMER1=-1

PLC-SPL

TITLE =Evaluation both inputs of acknowledgment button ok
AN        M 112.0;
A         DB18.DBX 44.1;
A         DB18.DBX 44.2;
=         M 112.1;

TITLE=Evaluation only one channel of acknowledgment button actuated
X         DB18.DBX 44.1;
X         DB18.DBX 44.2;
=         DB18.DBX 76.1;

TITLE =Evaluation of diff signals of acknowledgment button > 2 sec
A         DB18.DBX 76.1;
L         S5T#2S;
SD        T 112;
AN        DB18.DBX 76.1;
R  T 112;

A         T 112;
S         M 112.0;

TITLE =Automatic acknowledgment when both signal levels = 0
AN        DB18.DBX 44.1;
AN        DB18.DBX 44.2;
R         M 112.0;

TITLE =Output Signal
O         M 112.0;
O         DB18.DBX 128.0;
=         DB2.DBX 186.0;

TITLE =Transfer bit to NC SPL
A         M 112.0;
=         DB18.DBX 133.2;
```

END_FUNCTION

NCK MDs

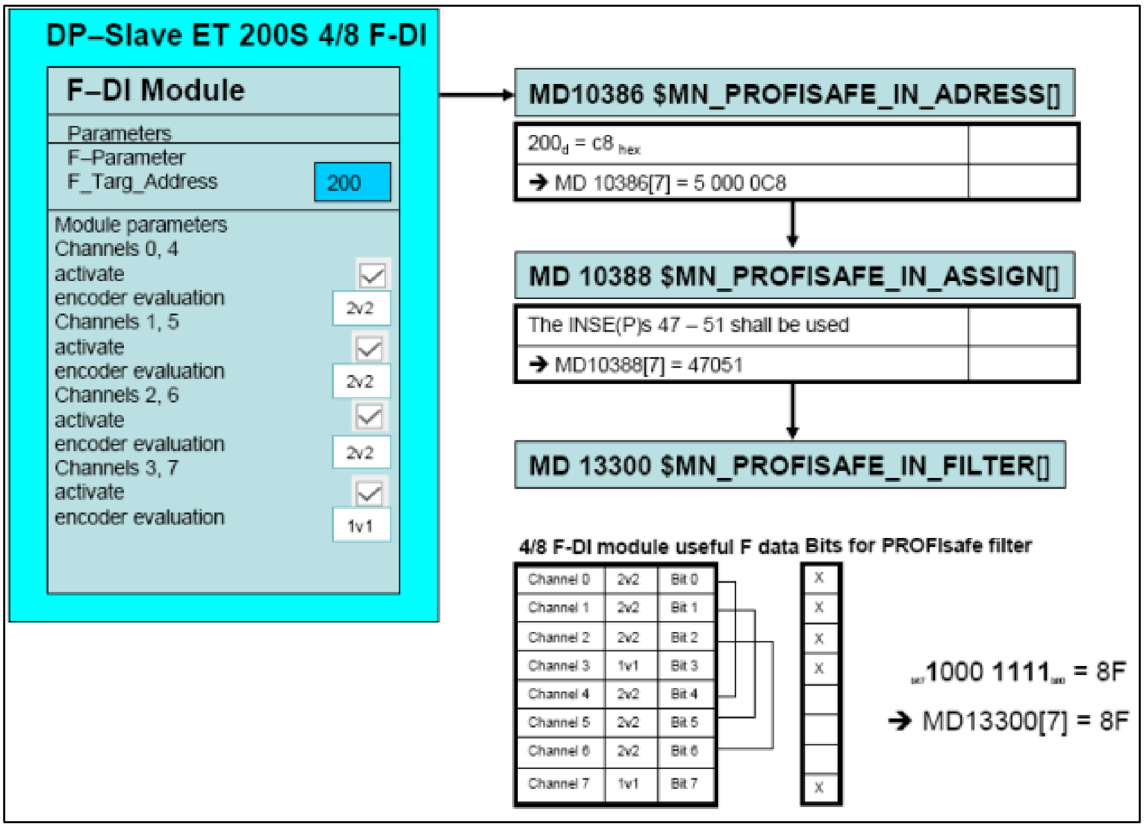


Fig. 219: SAFETY Integrated - ET200 settings

MD 10386: $MN_PROFISAFE_IN_ADRESS[0] 50000C8
MD 10388 $MN_PROFISAFE_IN_ASSIGN[0] = 47051

MD13300 $MN_PROFISAFE_IN_FILTER[5] = 8F

1oo1 would cause gaps in the address ranges of the INSE(P)s, so that some INSE(P)s would be rendered useless. The INSE(P)s are contracted to a gapless bit field with the PROFIsafe_IN_Filter.

10.2.8 SINUMERIK Safety Integrated blocks

10.2.8.1 Blocks

The following blocks are reserved in the Solutions for Power train concept for the Safety Integrated functionality:

- Data blocks
- DB 85 ... 89
- Function blocks

- FB 85 ... 89
- Functions
  FC 85 ... 89

A precise block-related agreement has been avoided in acknowledgment of the fact that the block structure can be different depending on how it is adapted to each application.

10.2.8.2 Functional scope of the SI application

The following functions must be implemented for integration of Safety Integrated into the PLC user program:

- When the "Safety-PowerOn" function is activated, SAFE.SPF is automatically started when booting. The system starts even if alarms are present.
- The function is activated by setting Bit 5 (Safety-PowerOn) in machine data 20108: $MC_PROG_EVENT_MASK.
- It is only possible to work with a restricted language scope in order that SAFE.SPF can be started in spite of the fact that alarms are active. The PLC or drives cannot be accessed.
- PLC-SPL (counterpart to logic of the NC in SAFE.SPF) typically implemented as FC
- Forced checking procedure sequential control incl. mechanical braking function test typically implemented as FC – can also be integrated in the FC for PLC-SPL
- Forced checking procedure of brake control typically implemented as FB with instance DB
- Forced checking procedure of shutdown paths (phase I) typically implemented as FC
- Forced checking procedure of external stops (phase II) typically implemented as FC
- Forced checking procedure of external SPL inputs and outputs (phase III) typically implemented as FB with instance DB

10.2.8.3 Basic program blocks

Available as from PLC basic program 06.03.03

FB 10: Safety software relay (SI relay)

The standard SPL "Safety relay" block is designed to support the implementation of an emergency stop function with safe programmable logic. However, it can also be used to implement other similar safety functions, e.g. control of a protective door.

Associated NCK function SIRELAY (equivalent function – can be integrated in SAFE.SPF)

Brake test

A: FB11 (included in GP)

The braking operation check should be used for all axes, which must be prevented from moving in an uncontrolled manner by a holding brake. This check function is primarily intended for the so-called "vertical axes".

E.g. when integrated in the forced checking procedure (shutdown paths / external stops ...), the brake is closed at a defined (and suitable) time. The drive then applies a torque / force (in addition to the torque or force resulting from self-weight of the axis). The brake is thus loaded with a defined torque / defined force. In error-free operation, the brake can produce the necessary braking torque / the necessary braking force and the axis will not move outside of a parameterized monitoring window. When an error occurs, the actual position value exits the monitoring window. In this instance, the position controller prevents the axis from sagging and negatively acknowledges the mechanical brake test.

B: Sinamics brake test

As an alternative to the function of FB11, the Sinamics brake test can also be used.

Information about the brake test and commissioning is provided in the relevant documentation.

https://support.industry.siemens.com/cs/ww/en/view/109477754

10.2.9 Configuring the functions

The basics of configuration are:

- Risk analysis of the machine as a starting point, including analysis of dangerous movements, crushing limits, ...
- Definition of the necessary measures for reducing risks
- Definition of effective safety zones
- Selecting the mechanical protective equipment (e.g. impact strength criterion)
- Defining the safety functions
- Determining the required Performance Levels (PL) acc. to EN ISO 13849 or Safety Integrity Levels (SIL) acc. to EN 62061 of the safety functions

- Selecting safety-related sensors and actuators
- Calculation of PLC acc. to EN ISO 13849 or SIL acc. to EN 62061

The Safety Evaluation Tool (SET) is available to you for calculating the safety functions. This TÜV-tested online tool provides you with swift and reliable help in assessing the safety functions of your machine. It provides you with a standard-compliant report that can be integrated into the documentation as a safety verification.

https://new.siemens.com/global/en/products/automation/topic-areas/safety-integrated/factory-automation/support/safety-evaluation-tool.html

The manufacturer-independent tool, "Software-Assistent SISTEMA" provided by the IFA (Institute for Occupational Safety and Health of the German Social Accident Insurance) is also available to you.

Project libraries containing the Siemens components for SISTEMA can be ordered through your Siemens contact person.

The configuration should be performed for the following components

- Configuration of the single unit or machining center
- Configuration of the master control
- Configuration of the coupling function (signal exchange, interaction ...)

The SI safety functions and protective equipment used on an individual machine and their effect is described in the SI configuration with the following content:

- System description
  - Machine
  - Control system
  - Configuration diagram
- Description of the safety functions
  - Function table
  - SI functions for each drive
  - Safety equipment
  - Test stop
- Hardware installation
- Declarations SPL implementation

A Word form is available for the SI configuration. We recommend that you use this form to describe the safety functionality.

10.2.10 Acceptance test and acceptance report

For machine commissioning, all safety functions of the electrical drive systems must be tested in an acceptance test and the results recorded. This applies to all electrical drive systems regardless of whether the safety functions are implemented using controllers and drives with integrated safety or using external monitoring equipment.

The acceptance test must be performed every time a new machine type undergoes first commissioning. The machine manufacturer is responsible for performing the acceptance test the result of which must be documented in an acceptance report.

The acceptance test comprises a final check of the implemented safety functions. Any incorrect parameter settings and programming are detected by the acceptance test.

- Full acceptance test: In a full acceptance test, all intended safety functions, compliance with limit values, command encoder functions, actuator functions, must be checked. The entire fault response chain from the sensor through the control to the actuator is run through and correct functioning of the safety functions checked.
- Partial acceptance test: In a partial acceptance test, all those safety functions are tested that are affected by changes to safety-related data.

The acceptance test is the continuation of the SI configuration with the the following aspects.

- DOCUMENTATION Documentation of the machine incl. safety functions
- FUNCTION TEST PART 1 General function check incl. checking the wiring / programming
- FUNCTION TEST PART 2 Detailed function test incl. checking the values of the SI functions used
- SUPPLEMENTARY MEASURES
- FINAL REPORT Report of the generating commissioning status and appropriate counter-signatures
- APPENDIX Reports/Measurement records for FUNCTION TEST PART 1 and 2

The acceptance test must be performed on the following components:

- Single unit or machining center
- Master control and/or loading system, usefully together with the coupling functions
- Coupling functions (signal exchange, interaction ...)

The acceptance report provides the machine manufacturer and the end customer with a document that clearly states which safety functions have been configured and tested how.

Using checksums and time stamps (in the system), it is possible to track subsequent changes.

The function "semiautomated acceptance test" with integrated acceptance report and interactive operator guidance is included in "Safety Integrated" for the acceptance test and creation of a report.

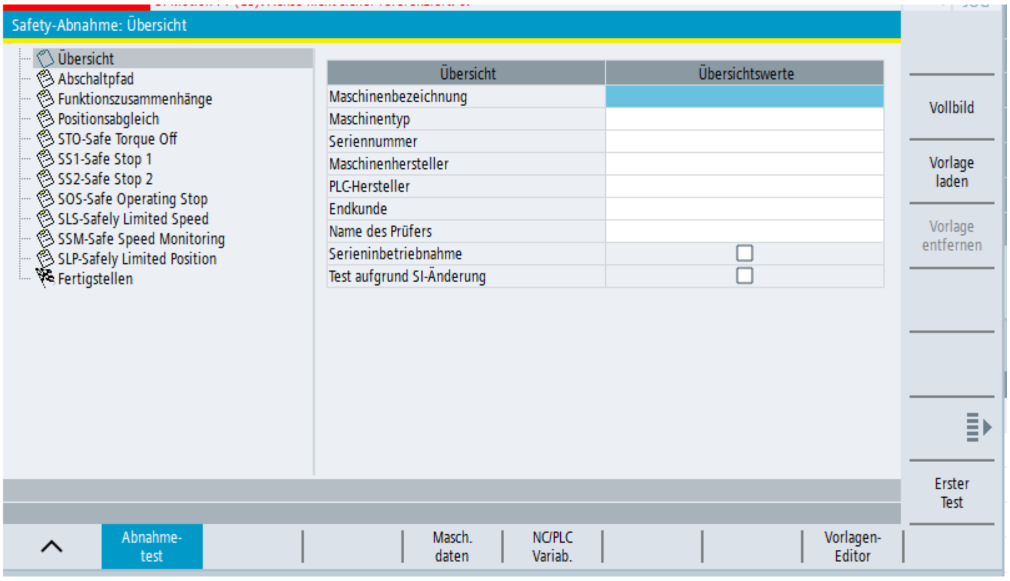


Fig. 220: Overview of acceptance test Operate

The acceptance test is integrated in the HMI and can be executed in full from there.

The completed report is backed up onto the control and can be retrieved at any time.

A template for simplified guidance through the acceptance test can be created and loaded.

The requirement to perform an acceptance test is stated in the Machinery Directive 2006/42/EC.

10.2.11 Procedure for replacing modules

When safety-related hardware is replaced, the checksums may change so that they subsequently no longer match those in the acceptance protocol.

To guarantee that the system or plant is in a safe state nevertheless, the following tests and checks must be performed:

The table below lists which measures are to be performed if the following are replaced

- NCU
- NX
- Motor Module

It is assumed that modules are replaced with the same type (same MLFB). The description of the work to be performed is explained in more detail below the table.

Measure	Documentation	Function test Part 1	Function test Part 2	Additional measures	Completion of the report
Replace the Motor Module	Supplement Hardware data /Software version data	Yes, Point 4.6	No	Point 4.1	Counter signature
NCU hardware replaced	Supplement Hardware data /Software version data	Yes, Point 4.6	No	Point 4.1	Counter signature
NX hardware replaced	Supplement Hardware data /Software version data	Yes, Point 4.6	No	Point 4.1	Counter signature

Table 55: SAFETY Integrated – Replacing modules

10.2.11.1 Content of the complete acceptance test

1) DOCUMENTATION

Documentation of the machine including the safety functions

1.1 Machine description (with overview)

1.2 Details about the control system

1.3 Configuration diagram

1.4 Function table

Active monitoring functions depending on the operating mode, the protective doors and

other sensors/CPU-CPU communication. Ideally, this table should be the objective and result of the configuring work.

1.5 SI functions per axis

1.6 Information about safety equipment

2) FUNCTION TEST PART 1

General function check incl. checking the wiring/programming/

Configuration

2.1 Test the shutdown paths

(Check of the forced checking procedure of the shutdown paths)

2.2 Test the external stop

2.3 Test the brake control of the holding torque

2.4 Test the forced checking procedure of the inputs and outputs

2.5 Test of the emergency stop function and of safety circuits

2.6 Test all SPL switching states and associated input/output signals

2.7 Test the PROFIsafe input/output signals

3) FUNCTION TEST PART 2

Detailed function test incl. checking the values of the individual SI functions used

3.1 Test the SI function safe operating stop – SBH/SOS

(with evaluated measurement diagram or measured values)

3.2 Test the SI function safely reduced speed – SG/SLS

(with evaluated measurement diagram or measured values)

3.3 Test the SI function safety-related output n < nx

(with evaluated measurement diagram or measured values)

3.4 Test the SI function safe limit positions – SE

(with evaluated measurement diagram or measured values)

3.5 Test the SI function safe cams – SN

(check using the diagnostics display or assigned SGAs or with the evaluated measuring

diagrams and measured values)

3.6 Possibly test the SI function external stops

(with evaluated measurement diagram or measured values)

3.7 Test the SI function SBC/SBT

(with evaluated measurement diagram or measured values / PROFIsafe I/Os)

4) Supplementary measures

4.1 Function test actual value acquisition

a. General testing of the actual value sensing

> After replacing a component, the system is switched on and briefly operated in both

directions.

4.2 Check the SGE/SGA signals of the relevant module

4.3 After changing the acceleration behavior/jerk, axis-specific tests of the function test

Part 2

4.4 Test the new safety functionality

4.5 Check the checksums and software versions, comparing whether checksums and

software versions are identical with the reference machine. Hardware checksum 36998[1]

is always different from that of the reference machine.

4.6 Working through the forced checking procedure

(test of the shutdown paths, test of the external stops)

Recommendation: A forced checking procedure should be automatically performed each time the

control system is powered up.

10.3 SAFETY specifications SINAMICS S120

10.3.1 Comparing topologies

10.3.1.1 Description

In the topology comparison, the quality of the comparison is defined by four levels, which can influence device replacement:

The requirements are adequate.

High: Compares the entire electronic rating plate

- Component type (e.g. "SMC20")
- Order number (e.g. "6SL3055-0AA0-5BA0")
- Manufacturer (e.g. SIEMENS)
- Hardware version (e.g. "A")
- Serial number (e.g. "T-P30050495")

Medium: Compares the component type and the order number

- Component type (e.g. "SMC20")
- Order number (e.g. "6SL3055-0AA0-5BA0")

Low: Compares the component type

- Component type (e.g. "SMC20")

Minimal: Compares the component class

- Sensor Module or Motor Module

10.3.1.2 Recommended setting for topology

The topology comparison level must be set to at least "Low"; it can be set to "Medium" if the OEM considers it necessary.

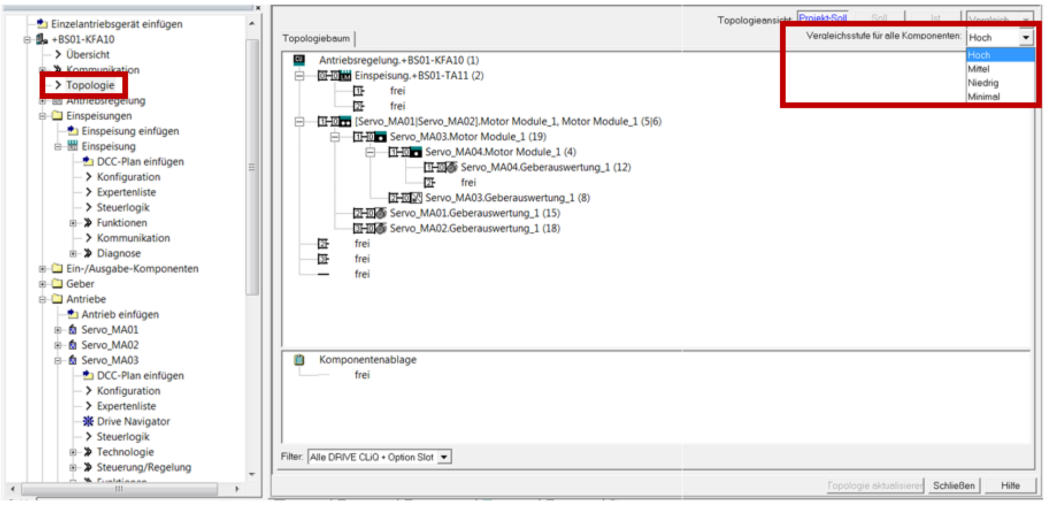


Fig. 221: Setting the topology comparison level

10.3.1.3 Topology comparison in combination with with Safety Integrated

For Safety, stricter rules apply when changing hardware The normal comparison level has no affect on Safety. This is particularly necessary for extended functions because for these the serial numbers go into the checksum.

If, in an S120 drive group with activated Safety functions, a Motor Module or a DQ motor is replaced, for example, the hardware-related Safety checksum will certainly change irrespective of the comparison level that has been set for the DQ topology.

The following steps are required:

1. Make sure that nobody is in the danger zone, and only then switch on the machine.
2. Note the following warnings for "Extended/Advanced Functions via PROFIsafe":
   – F01650 (fault value 2005) indicates the replacement of the Control Unit.
   – A01695 indicates the replacement of a Sensor Module.

   As a consequence, a defect is also signaled in a monitoring channel (C30711 with fault value 1031 and stop response STOP F).
3. Execute the function Acknowledge hardware replacement:
   – Faults F01650/F30650 are output (acceptance test required; see FHS, Chapter "Test scope for specific measures".
   https://support.industry.siemens.com/cs/ww/en/view/109763292
4. Perform Step 3 if replacing a Sensor Module on the Servo or Vector drive object and replacing a Motor Module on the TM54F_MA drive object (if installed).
5. Back up all parameters on the memory card (p0977 = 1).
6. Execute POWER ON (power off/on) for all components.

If the Safety Integrated Functions are being applied, the OEM must ensure that it is possible to transfer the checksum via the HMI and that the necessary documentation describing the procedures for restoring the plant to operation after replacement of a component is available.

10.3.2 Acknowledging hardware replacement

The functionality for "Acknowledge hardware replacement" must be implemented via the HMI.

Acknowledging hardware replacement with the STARTER software alone is not permissible.

10.3.2.1 Recommended procedure for "Extended/Advanced Functions"

We recommend using the Daimler module, which already contains this functionality.

10.3.2.2 S7-300F Using the supplier's own module

In the case of the S7-300F SIMATIC family, the function "Acknowledge hardware replacement" can be implemented with acyclic write requests via the PLC.

The following parameters must be written:

P0010 = 95	→	Activate "Safety Integrated commissioning"
P9700 = 1DHEX (29DEC)	→	Copy function for node identifier
P9701 = ECHEX (236DEC)	→	Confirm hardware CRC
P0010 = 0	→	Exit "Safety Integrated commissioning" mode
P977 = 1	→	Ram2Rom or
P972 = 1	→	PowerOn

The supplier is responsible for testing and ensuring that a self-written function is correctly executed.

10.3.2.3 Description of the HMI

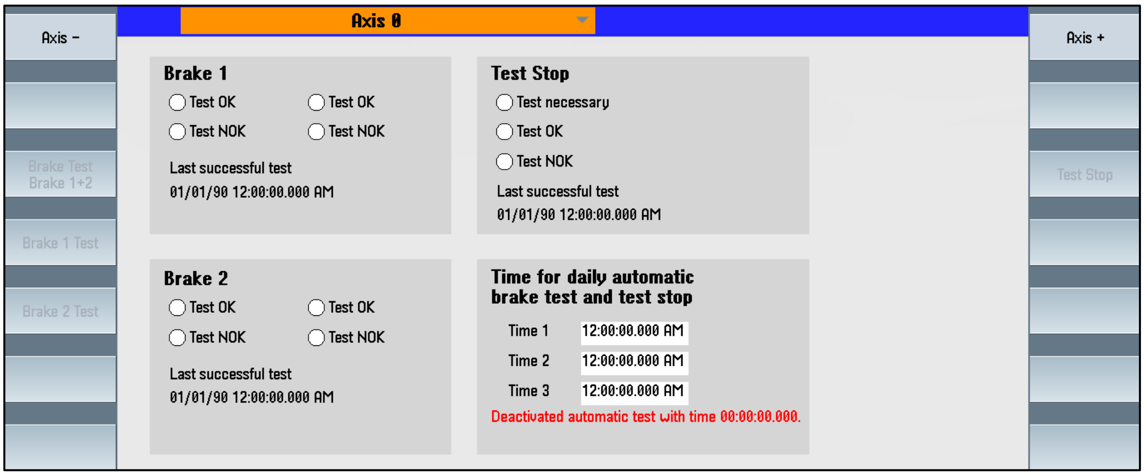


Fig. 222: S120 SAFETY example HMI template

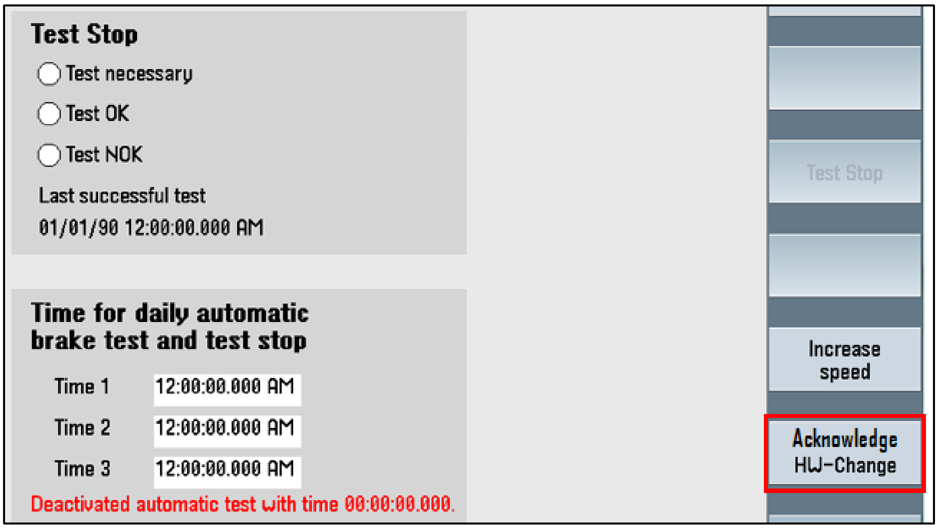


Fig. 223: Example Acknowledge hardware replacement

10.3.3 Increasing the maximum speed via the HMI for the safety acceptance test to test the safety function Safely-Limited Speed

To test the Safety Integrated Function Safely-Limited Speed (SLS), the function must be selected and a speed that exceeds the parameterized SLS limit occur.

For this, a button for activating the SLS safety function test must be created on the HMI. For example, by setting a bit.

The set bit must be evaluated accordingly in the controller and a command speed above the SLS limits parameterized in STARTER p9531[0...3] must be specified.

After the SLS test has been successfully completed and the test function has been deselected on the HMI, the command speed must be reset again so that it is below the SLS limits p9531[0...3].

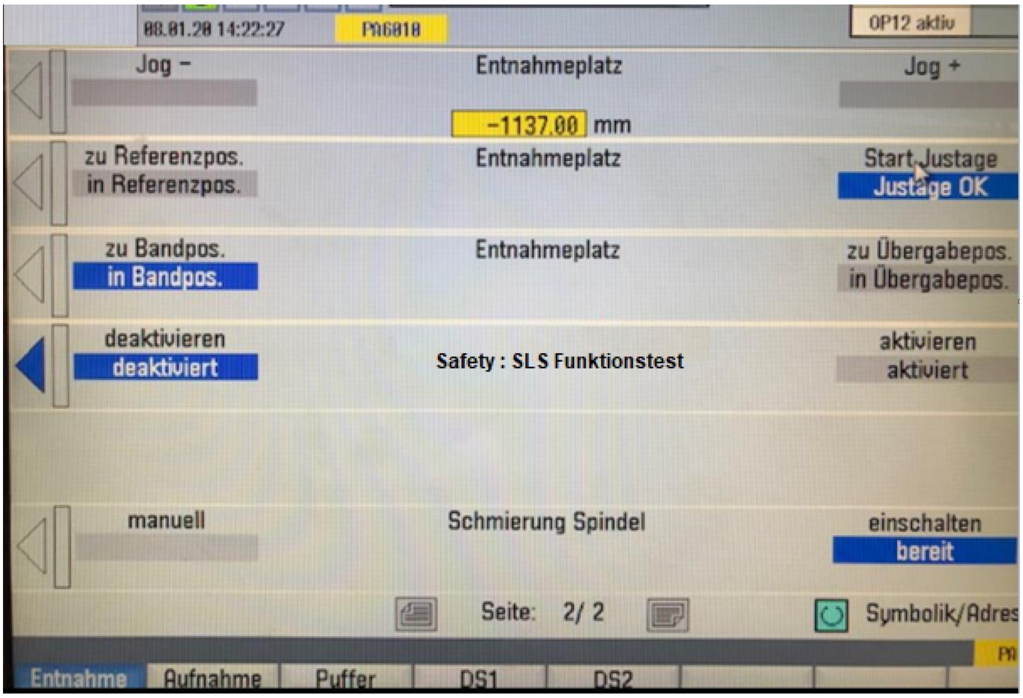


Fig. 224: Example Testing the SI function SLS

Danger	Danger to life due to axis movements during the acceptance for persons and machines During SLS testing, the axis may move suddenly. If persons are in the danger zone, accidents causing death or severe injury can occur. • Take suitable measures to ensure that nobody is in the danger zone during the test. • Take appropriate measures to avoid damage to the plant during a test, for example, by performing the test only at a suitable position on the plant and ensuring that a sufficient distance from the end stops is maintained.

10.3.4 Requirements for implementing the Safe Brake Test included in the Safety Integrated functions.

10.3.4.1 Information for software implementation

- Safe Brake Test (SBT) of brake 1 (motor holding brake) and test sequence 1
- Safe Brake Test (SBT) of brake 1 (motor holding brake) and test sequence 2
- Safe Brake Test (SBT) of brake 1 (motor holding brake) and test sequence 1 and 2

- Safe Brake Test (SBT) of brake 2 (external brake) and test sequence 1
- Safe Brake Test (SBT) of brake 2 (external brake) and test sequence 2
- Safe Brake Test (SBT) of brake 2 (external brake) and test sequence 1 and 2

By means of input parameter, it must be possible to specify whether test sequence 1, test sequence 2, or test sequence 1 and test sequence 2 will be executed. The OEM decides which test sequences are required based on a risk analysis.

Input parameters:

Parameter	Data type	Starting value	Description
iiBremse1TestSequenz	INT	0	Brake 1: motor holding brake test sequence: • 0=-- • 1=Seq1 • 2=Seq2 • 3=Seq1+2
iiBremse2TestSequenz	INT	0	Brake 2: external brake test sequence • 0=-- • 1=Seq1 • 2=Seq2 • 3=Seq1+2

Table 56: Input parameters for select the SBT test sequence

It must also be possible, depending on the sequences defined, to first execute the brake test of the motor holding brake and subsequently perform the test of the external brake.

After completion of the Safe Brake Test, the relevant outputs for feedback for a successful or failed Safe Brake Test must be output. The plant manufacturer is responsible for assessing the brake test result (OK or not OK) and for the proper documentation of the brake test results.

Communication and control is handled by telegram 701. It contains the Safety Information Channel (SIC) as the status word and Safety Control Channel (SCC) as the control word.

In this regard we recommend using the brake test block with documentation provided by Daimler.

10.3.4.2 Requirements for implementation in STARTER

Telegram 701/700 is created as follows. The following steps are performed in STARTER:

- Create additional data with receive length 5 words and output length 2 words
- Compare telegrams with the HW Config in the SIMATIC MANAGER
- Set parameter p60122 = [701] additional telegram 701, PCD-2/5
- Enable and parameterize the Safe Brake Test in the "Safety Integrated Functions" of the converter

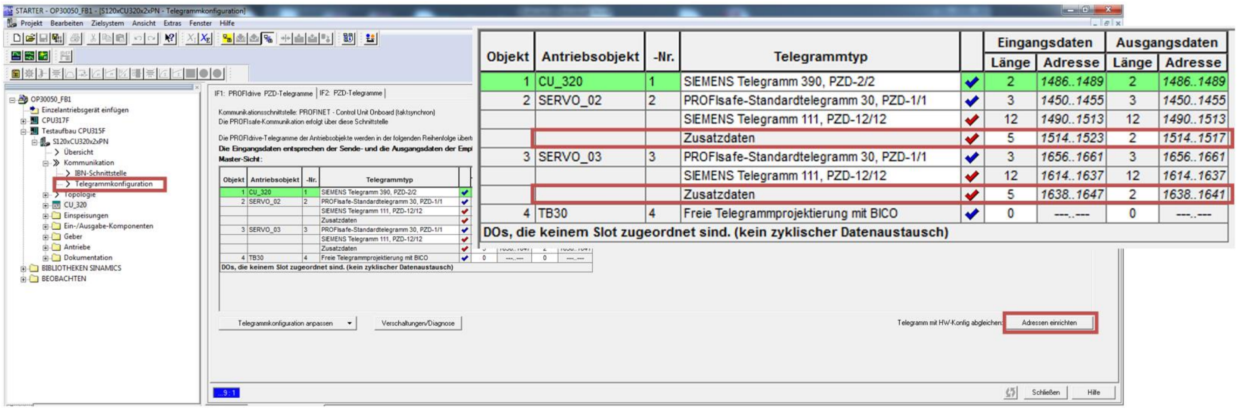


Fig. 225: SBT – Telegram configuration

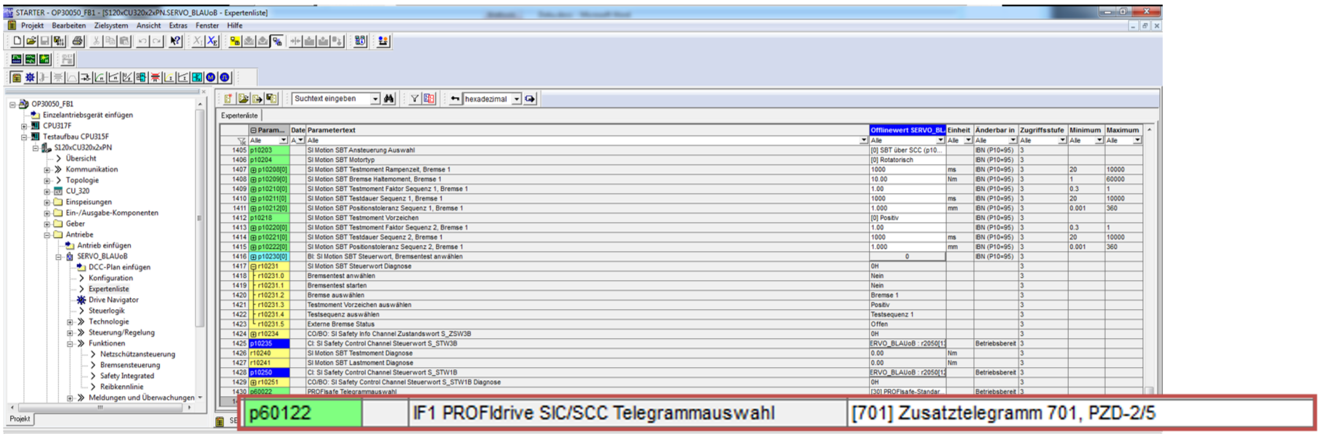


Fig. 226: SBT – Expert List Setting parameter p60122

Fig. 227: Safety Integrated SBT Enable

10.3.4.3 Information about HMI

The HMI template can be used to execute and show the brake test. If the HMI template is not used, a similar screen based on the template should be created, which contains the same functionalities.

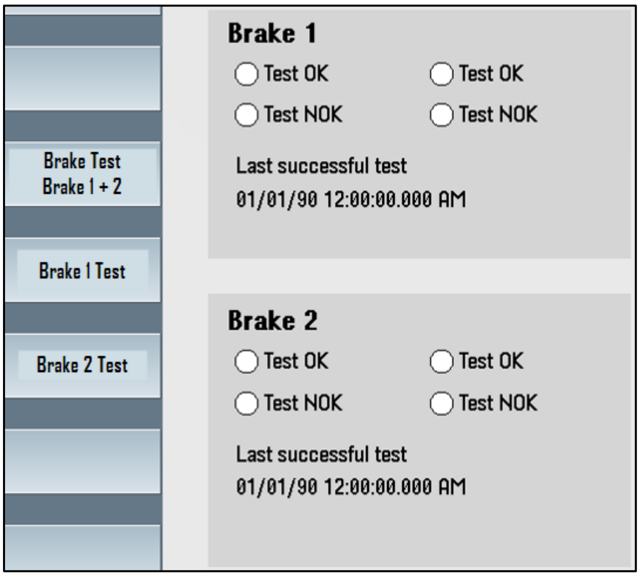


Fig. 228: HMI template SBT selection

10.3.4.4 Notes

A detailed description of the Safe Brake Test function and how it is controlled is provided in the following document:

SINAMICS S120 Safety Integrated Function Manual, Chapter "Safe Brake Test (SBT)"

Entry ID: 109771806

https://support.industry.siemens.com/cs/document/109771806/sinamics-s120-safety-integrated-function-manual?dti=0&lc=en-WW

10.3.5 Implementing test stop

The forced checking procedure (test stop) function must be implemented via the HMI.

The following settings must be made when the converter is commissioned:

10.3.5.1 Setting the forced checking procedure (test stop)

"Test stop" screen form

Parameterize the settings for the forced checking procedure (test stop) in the "Test stop" screen form. To meet the requirements of the DIN EN ISO 13849-1 and IEC 61508 standards in terms of timely fault detection, the converter must test its safety-related circuits regularly - at least once a year - for correct functioning. The converter monitors the regular test of its safety-related circuits that monitor the speed of the motor, and to safely interrupt the torque-generating energy supply to the motor through the safe pulse suppression.

10.3.5.2 Test stop for Basic Functions

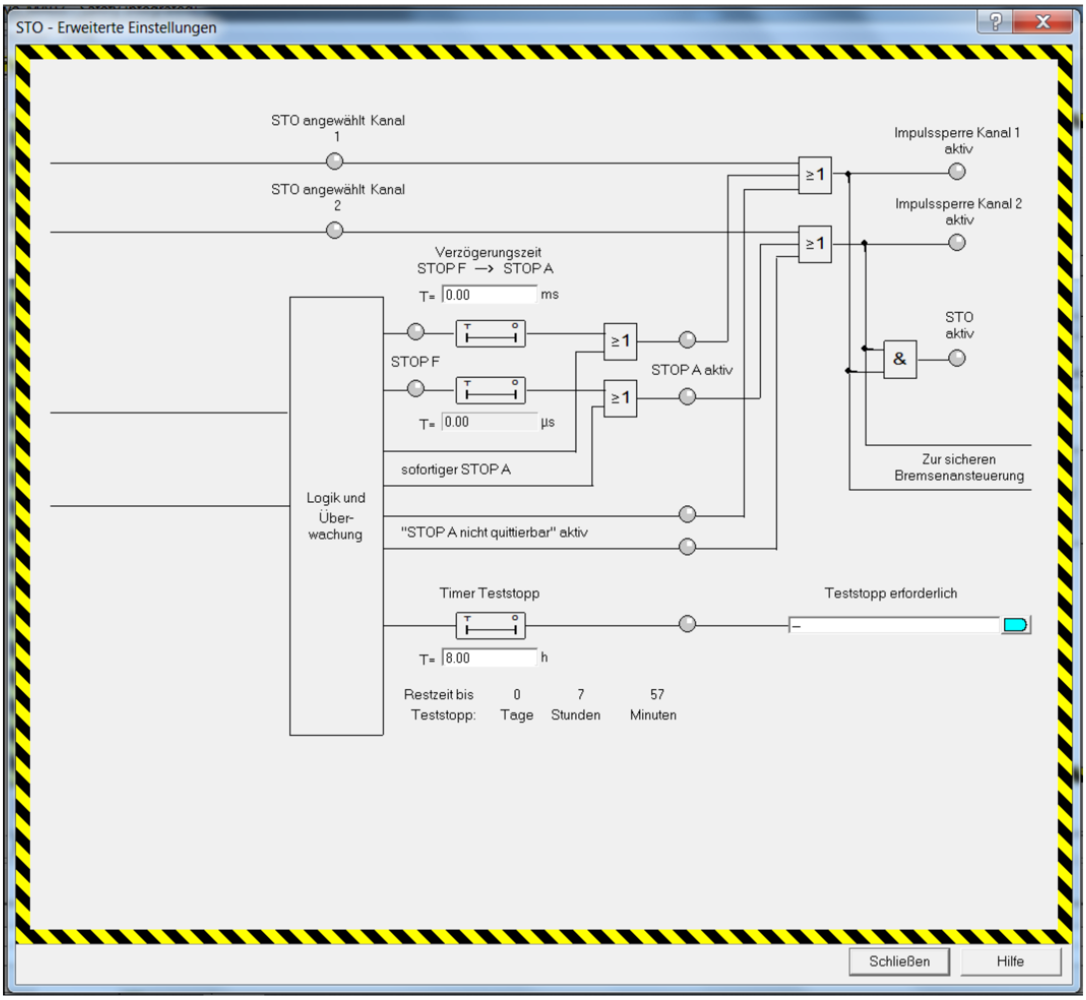


Fig. 229: Test stop - Basic Functions (Starter)

To parameterize the forced checking procedure (test stop) for the Basic Functions, proceed as follows:

1. Enter the interval for performing the forced checking procedure and testing the Safety switch-off signal paths in the "Timer" (p9659) field. Within the parameterized time, the "STO" function must be selected and deselected at least once. The monitoring time is reset at every STO deselection.
2. Evaluate the warning A01699 in your higher-level control, e.g. r9773.31 with a digital output or a bit in the status word of the field bus.

Resetting the timer of the Basic Functions

If the associated forced checking procedure (test stop) is performed while the Extended/Advanced Functions is simultaneously used, the Basic Functions timer is also reset.

While STO is selected via the Extended/Advanced Functions, the terminals for the selection of the Basic Functions are not checked for discrepancy. This means that the forced checking procedure (test stop) of the Basic Functions must always be performed without the selection of STO or SS1 via the Extended/Advanced Functions. It is otherwise not possible to verify the correct control by the terminals

10.3.5.3 Extended/Advanced Functions test stop

Note	If the "Basic functions via onboard terminals" option is active for the Extended/Advanced Functions, you must make the test stop settings for the Basic Functions as well as for the Extended/Advanced Functions.

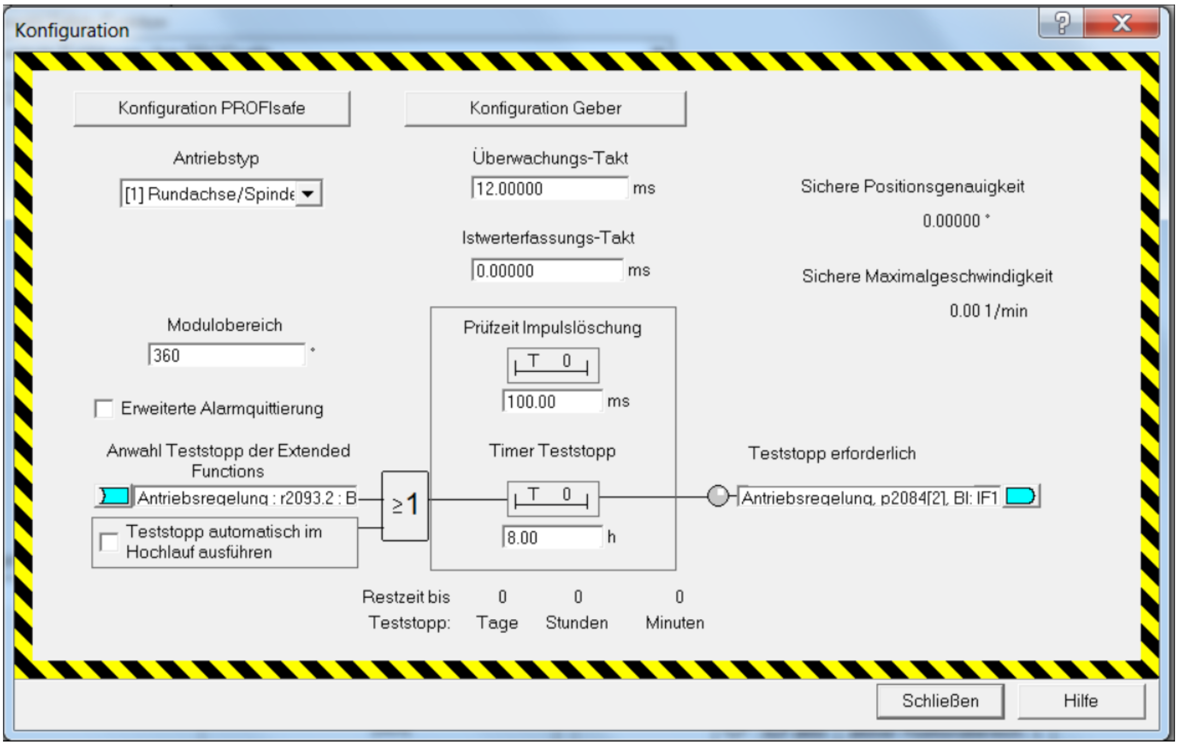


Fig. 230: Extended and Advanced Functions (Starter)

The circuits of the "Basic Functions" are a component of the circuits of the "Extended/Advanced Functions". If you use "Extended/Advanced Functions", you must take the following steps during commissioning:

To parameterize the forced checking procedure (test stop) for the Extended Functions, proceed as follows:

1. If the test stop is to be executed during ramp-up, establish a connection for "Execute test stop automatically during ramp-up". The line in the button must be continuous.
   - or -
   If the test stop is not to be executed automatically during ramp-up, select the signal (p9705) that is to trigger the forced checking procedure. Make sure that the connection for "Execute test stop automatically during ramp-up" is interrupted.
2. Enter the interval for performing the forced checking procedure and testing the Safety switch-off signal paths in the "Timer" (p9559) field. Within the parameterized time, the "STO" function must be selected and deselected at least once. The monitoring time is reset at every STO deselection.
3. Connect the "Test stop required" (r9723.0) signal sink to a digital output or to a bit in the status word of the fieldbus.

10.3.5.4 Executing the forced checking procedure (test stop)

If the converter signals alarm A01699 or A01697, you must initiate the forced checking procedure (test stop) at the next opportunity. These alarms do not affect the operation of your machine. You should shut down the drive before you perform the forced checking procedure (test stop).

Note	**Internal selection of STO** Initiating the forced checking procedure (test stop) causes STO to be selected internally. In this case, drives that were previously not stopped, or that do not have a holding brake, coast down.

Note	**Requirements** STO is triggered when a test stop is performed for the Safety functions. It is not permissible for STO to be selected before the test stop is selected. When blocksize Power Modules are used, the test stop must be triggered under controlled standstill conditions (set speed 0, motor energized)

10.3.5.5 Initiating the forced checking procedure (test stop)

Extended/Advanced Functions

You define the signal with which the converter tests its circuits for speed monitoring. Alternatively, the test can be automatically performed each time that the power supply voltage is switched on (POWER ON).

To ensure that the forced checking procedure (test stop) is performed without error, it is not permissible that STO is active.

If you select the forced checking procedure (test stop), the converter checks the circuits of Extended/Advanced Functions and Basic Functions.

Basic Functions

The converter checks its circuits for interruption of the torque-generating energy feed to the motor for one of the following conditions:

- After the power supply has been connected (POWER ON).
- Every time function STO or SS1 is selected.
- For the forced checking procedure (test stop) of the Extended Functions.

10.3.5.6 Examples of the instants at which the forced checking procedure (test stop) is performed

- When the drives are at a standstill after the system has been switched on
- When the protective door is opened
- In defined cycles (e.g. every 8 hours).
- Automatically each time the supply voltage is connected (POWER ON).
- In the automatic mode, dependent on the time and event

Note	**Test stop of a CU310-2** The pulses must be enabled when conducting a test stop at a CU310-2: Here, the drive should be switched on with Nset = 0.

10.3.5.7 Recommended procedure for "Extended/Advanced Functions"

Using the Safety Info Channel and Safety Control Channel (SCC/SIC)

The predefined PROFIdrive telegrams 700 and 701 are available for the transfer of the SIC and the SCC:

Here, we recommend using PROFIdrive telegram 701 and control blocks LDrvSafe_SinaTlg701Control and LDrvSafe_SinaTlg701Status from the "SIMATIC - Failsafe LDrvSafe library for controlling Safety Integrated Functions for the SINAMICS drive family"
(Entry ID: 109485794)
https://support.industry.siemens.com/cs/document/109485794/simatic-failsafe-library-ldrvsafe-to-control-the-safety-integrated-functions-of-the-sinamics-drive-family?dti=0&lc=en-WW

10.3.5.8 Alternative 1: Test stop via supplier's own block

Alternatively, a control block written specifically for the task can be used. In this case, it is important that the relevant bits are set and evaluated when the SCC/SIC is used:

	Empfangsdaten	Parameter	Sendedaten	Parameter
PZD1	S_STW1B	p10250	S_ZSW1B	r9734
PZD2	S_STW3B	p10235	S_ZSW2B	r9743
PZD3	–	–	S_V_LIMIT_B	r9733[2]
PZD4	–	–		
PZD5	–	–	S_ZSW3B	r10234

Fig. 231: Structure of telegram 701

Note	**Update of the send data** The send data S_ZSW2B and S_ZSW3B are only updated if the Safety Integrated Extended/Advanced Functions are enabled.

Bit	Meaning	Remarks		Parameter
0...7	Reserved			
8	Extended/Advanced Functions Forced checking procedure (test stop)	1	Extended/Advanced Functions forced checking procedure (Test stop) selected	r10251.8
		0	Extended/Advanced Functions forced checking procedure (Test stop) deselected	
9...15	Reserved			

Table 57: Safety Control Channel control word 1 (S_STW1B)

Bit	Meaning	Remarks		Parameter
0...3	Reserved			
4	SLP selected position range	1	SLP area 2 selected	r9743.4
		0	SLP area 1 selected	
5.6	Reserved			
7	SLP selected and user agreement	1	SLP selected and user agreement set	r9743.7
		0	SLP selected or user agreement not set	
8	SDI positive	1	SDI positive selected	r9743.8
		0	SDI positive deselected	
9	SDI negative	1	SDI negative selected	r9743.9
		0	SDI negative deselected	
10, 11	Reserved			
12	Test stop active	1	Test stop active	r9743.12
		0	Test stop not active	
13	Test stop required	1	Test stop required	r9743.13
		0	Test stop not required	
14	Reference position required	1	Reference position required	r9743.14
		0	Reference position not required	
15	Reference trigger command identified or reference position valid	1	Reference trigger command identified or reference position valid	r9743.15
		0	No reference trigger command identified or reference position invalid	

Table 58: Safety Info Channel status word 2 (S_ZSW2B)

Creating the SCC/SIC in STARTER

Telegram 701/700 is created as follows. The following steps are performed in STARTER:

- Create additional data with receive length 5 words and output length 2 words
- Compare telegrams with the HW Config in the SIMATIC MANAGER
- Set parameter p60122 = [701] additional telegram 701, PCD-2/5
- Enable and parameterize the Safe Brake Test in the "Safety Integrated Functions" of the converter

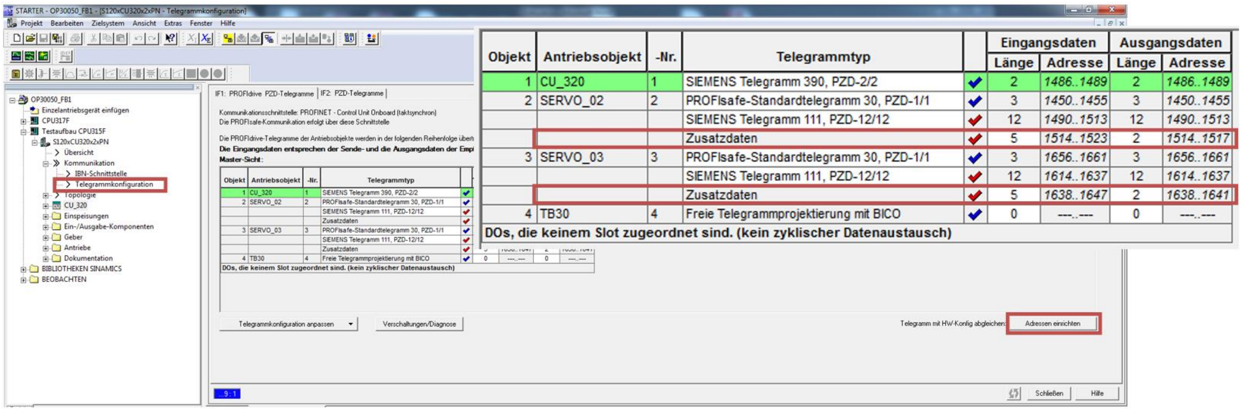


Fig. 232: Test stop - Example Telegram configuration

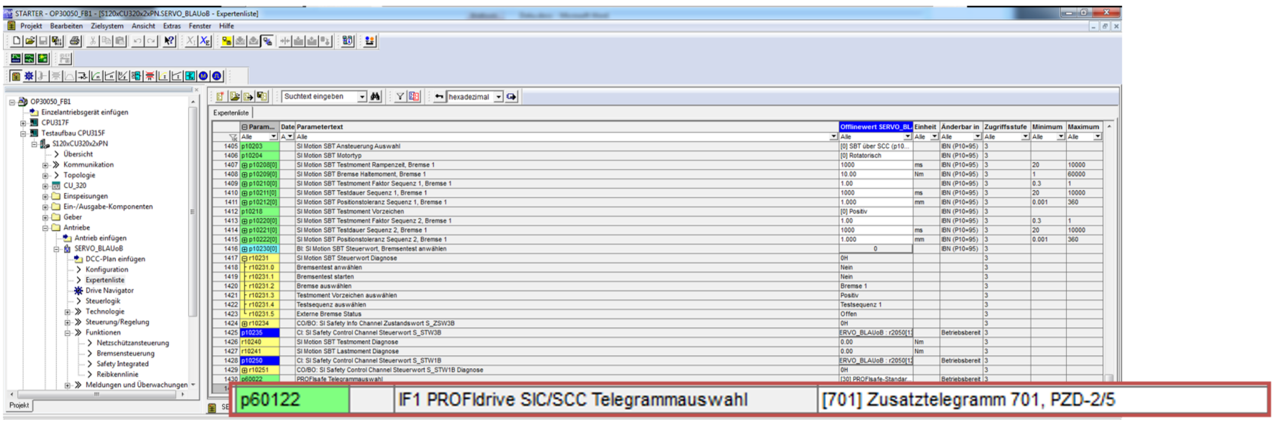


Fig. 233: Test stop – Example Expert List Setting of parameter p60122

10.3.5.9 Alternative 2: Test stop via BICO interconnection

If SCC/SIC is not used for the forced checking procedure (test step) and the selection is made via BICO interconnection. In this case, the relevant signals "Test stop required" (r9723.0) and p9705 "SI Motion test stop signal source" must be assigned and evaluated.

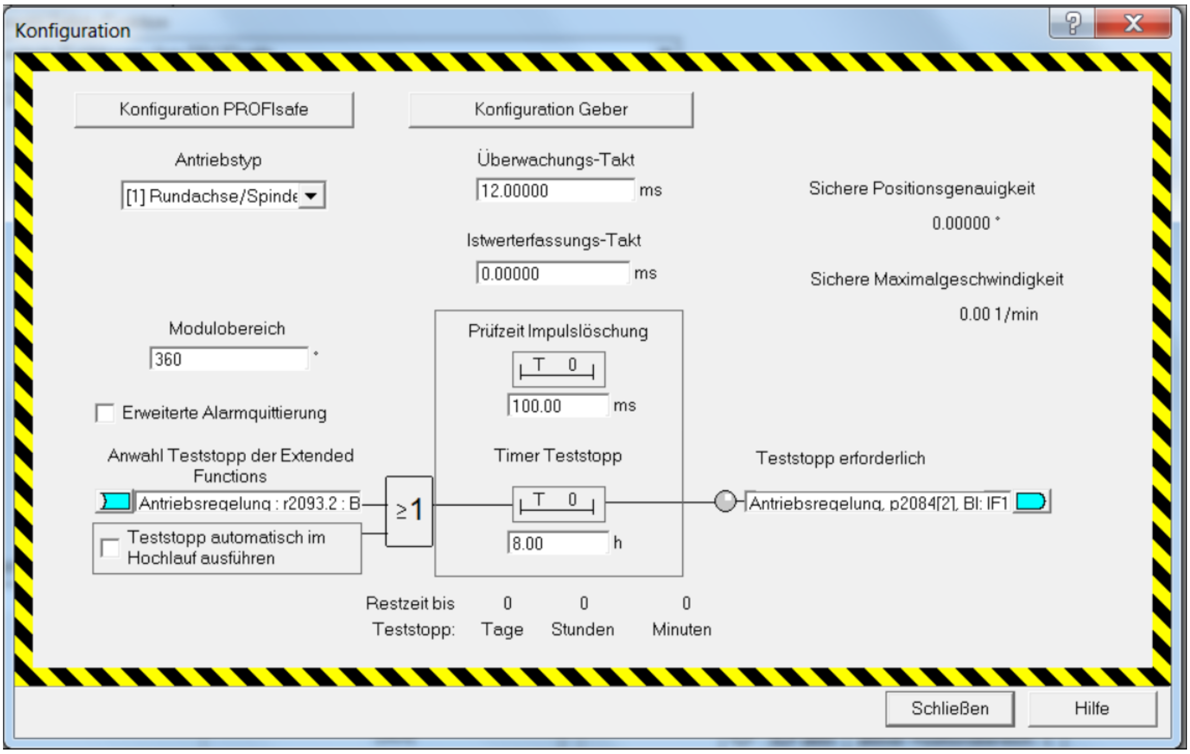


Fig. 234: Example: Extended and Advanced Functions (Starter)

10.3.5.10 Requirements for HMI

The HMI template can be used to execute and visualize the forced checking procedure (test stop). If the HMI template is not used, a similar screen based on the template should be created that contains the same functionality.

Fig. 235: Example HMI template Test stop selected

11 Appendix

11.1 Service and Support

Industry Online Support

Do you have any questions or need assistance?

Siemens Industry Online Support offers round the clock access to our entire service and support know-how and portfolio.

The Industry Online Support is the central address for information about our products, solutions and services.

Product information, manuals, downloads, FAQs and application examples – all information is accessible with just a few mouse clicks:
https://support.industry.siemens.com

Technical Support

The Technical Support of Siemens Industry provides you fast and competent support regarding all technical queries with numerous tailor-made offers
– From basic support up to individual support contracts.

Use the web form to send queries to Technical Support:
www.siemens.com/industry/supportrequest

Service portfolio

Our range of services includes the following:

- Product training
- Plant data services
- Spare parts services
- Repair services
- Field and maintenance services
- Retrofit and modernization services
- Service programs and contracts

You will find more detailed information about our service portfolio in the service catalog:
https://support.industry.siemens.com/cs/sc

Industry Online Support app

With the "Siemens Industry Online Support" app, you can obtain optimum support, even when you are on the move. The app is available for Apple iOS, Android and Windows Phone:
https://support.industry.siemens.com/cs/ww/en/sc/2067

11.2 Links and references

No.	Topic
\1\	Siemens Industry Online Support https://support.industry.siemens.com
\2\	Link to Daimler extranet https://support.industry.siemens.com/cs/ww/en/view/109764218

Table 59: Links and references

11.3 Change documentation

Version	Date	Revision
V1.1.1	04/2021	First release

Table 60: Change documentation