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CUSTOM STEP TYPES DESCRIPTION FOR ABB M4M

Rel 02.04.000

	Customer:	ABB S.p.A.	1/79
	Document	CUSTOM STEP TYPES DESCRIPTION FOR ABB M4M	
	Code: Revision: Date:	ABB M4M Rel 02.04.000 07/03/2022	

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1 REVISIONS

1.1 Manual revisions


Revision/ Date	Revision Description	Author
21/12/2020	First release	Stefano Orsetti
11/01/2021	Version modified following ABB review and notes	Stefano Orsetti
01/07/2021	Step type Omicron and Modbus added	Roberto Munaretto
01/10/2021	Sniffing display step type for HMI added	A. Rivolta
26/11/2021	Updated step type regarding sniffer display for HMI and added step type for physical keypad simulation.	M. Molteni
15/02/2022	Added step types related to Omicron and updated and added step types related to HMI M4M.	M. Molteni
07/03/2022	Type palettes tree added and document translated.	M. Molteni

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2 CUSTOM STEP TYPES MODBUS M4M

This chapter describes the custom Step Types created for performing tests related to the M4M ABB product using the NI-TestStand test sequencer.

In the "Edit" panel, whose functionality is specifically explained in section 4.1, the structure of the steps is the same for everyone, therefore, common commands are described below.

RUN: Executes the custom step, the function that is executed when the sequence is running.

SAVE: Saves the changes made in the Edit panel, which will be used during sequence running. The Edit panel is then closed.

CANCEL: Ignores the changes made in the Edit panel and keeps the parameters from the previous configuration. The Edit panel is then closed.

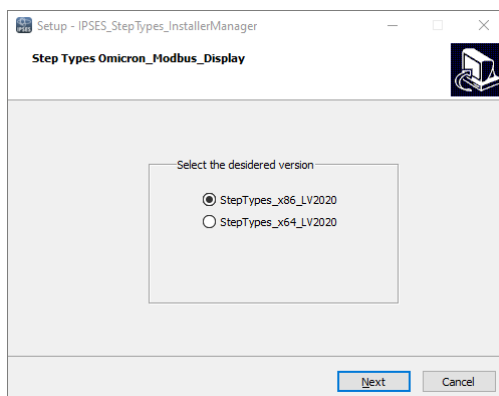
REVERT: Ignore and erase the changes made in the Edit panel recovering the initial ones (at the start of the Edit panel)

For each Step Types additional properties are described (the Step Properties) that characterize the step and allow to save the configurations set in the Edit phase.

Before installing the step types all software requirements must be installed on the target system (LabView Runtime, TestStand, VISA, Vision and NI-845x), see 7.1 for more details.

Start installation with the .exe (e.g.: "IPSES_StepTypes_InstallerManager_v2010.exe") and follow the instruction:

- Chose application bitness




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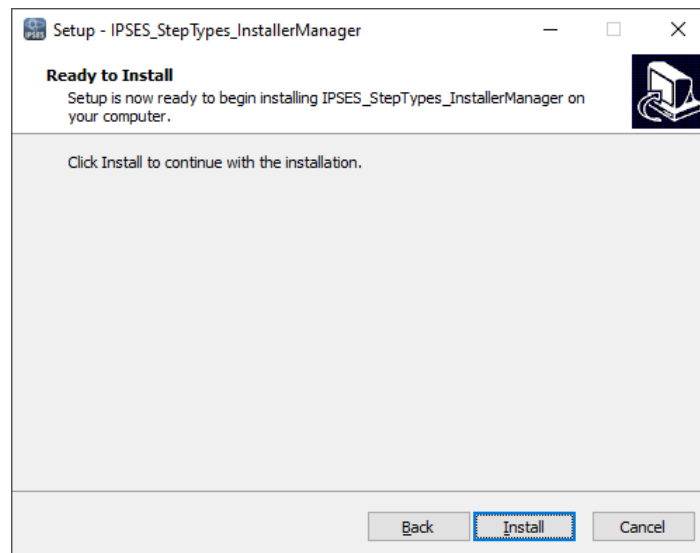
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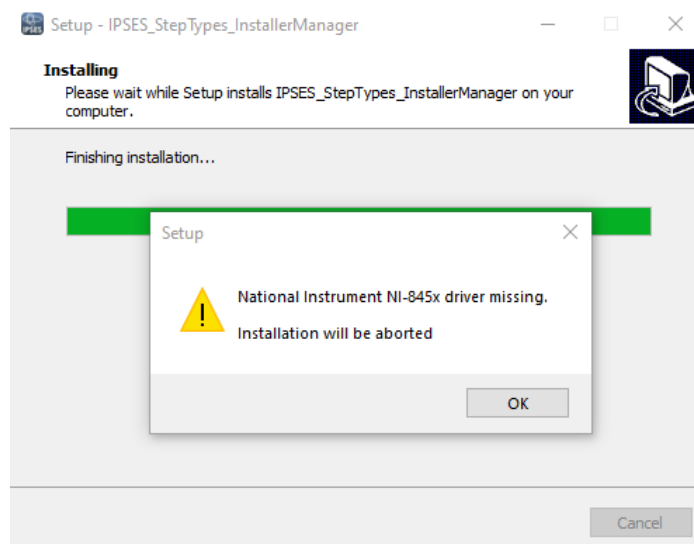
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- The installer with correct bitness is then unpacked and ready to be installed



- If a software requirement is missing an Abort popup will appear




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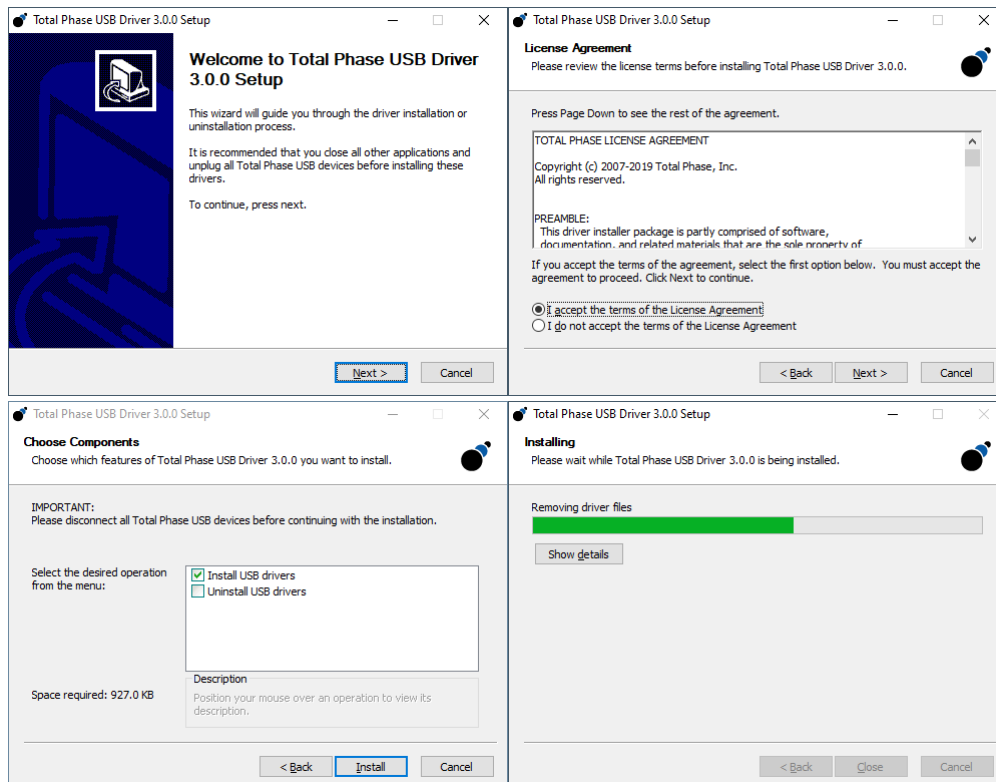
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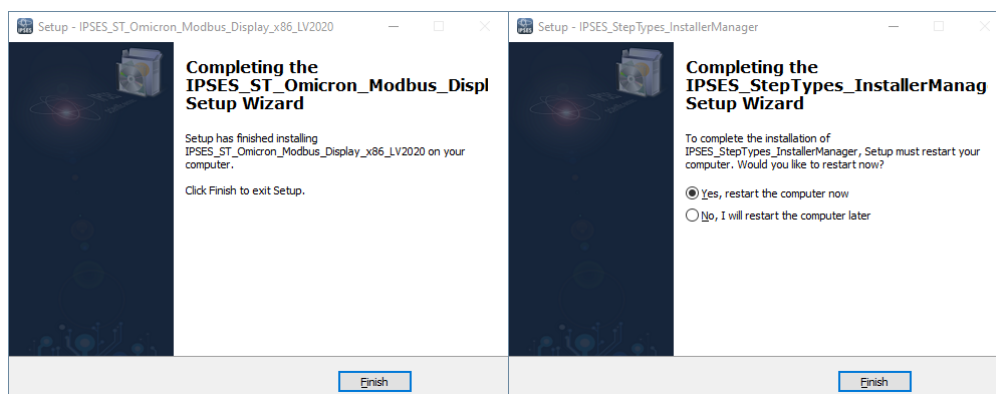
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- Otherwise, the procedure continues and once the step types installation is finished, the installation for the “Sniffing” USB device driver starts (if the driver is already present, this procedure could be cancelled):



- The installation is now complete and a reboot is asked




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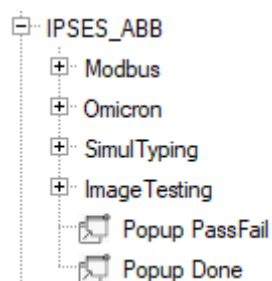
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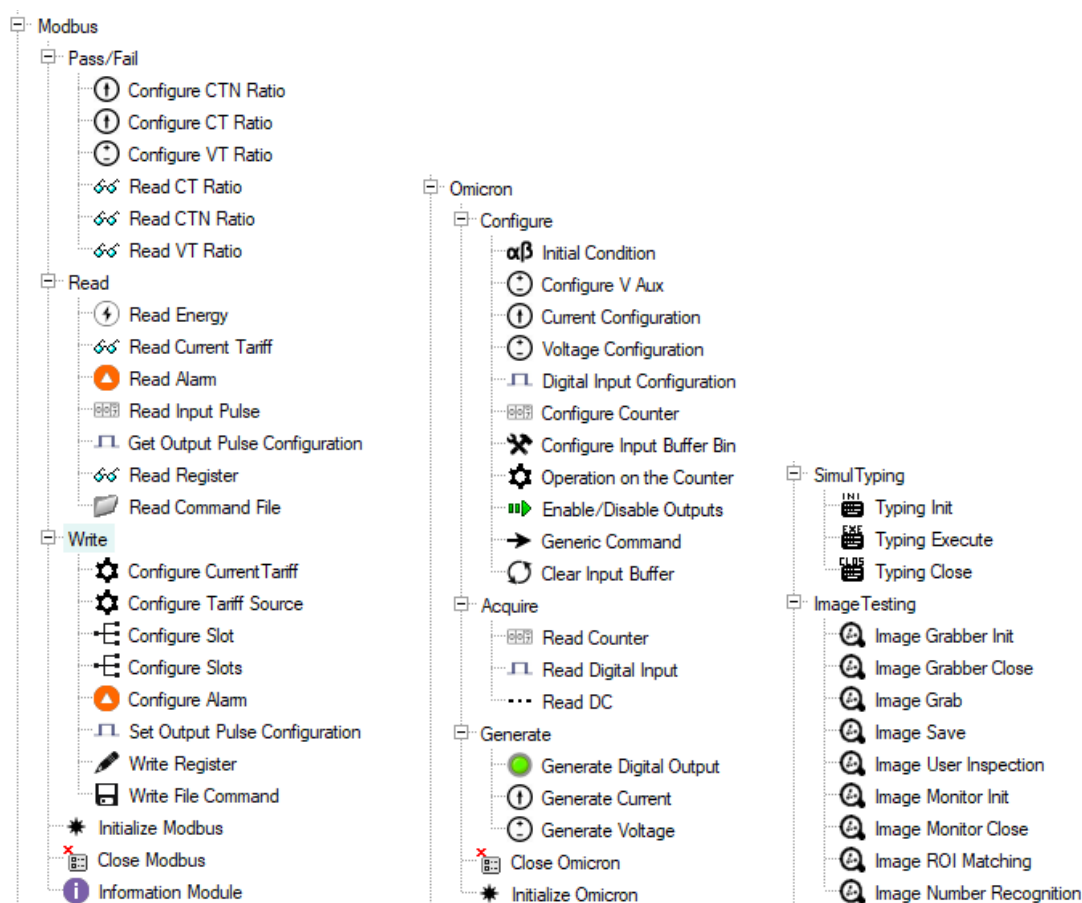
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The insertion palette of TestStand, after installation, will expose the following palette tree:



Expanding each node of the tree, all the custom step types are accessible:




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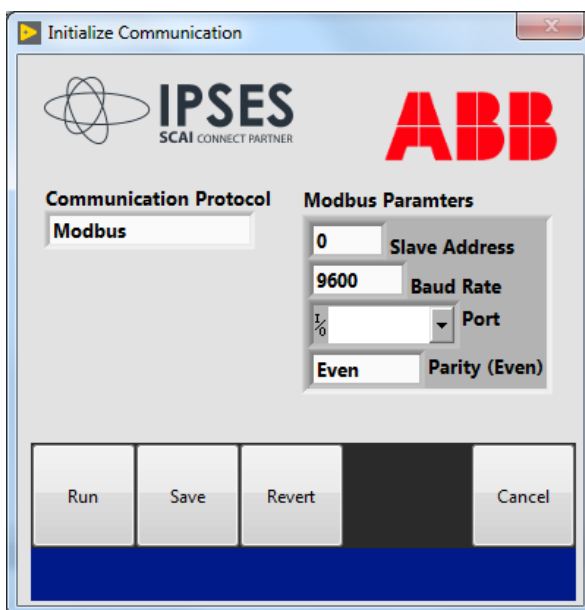
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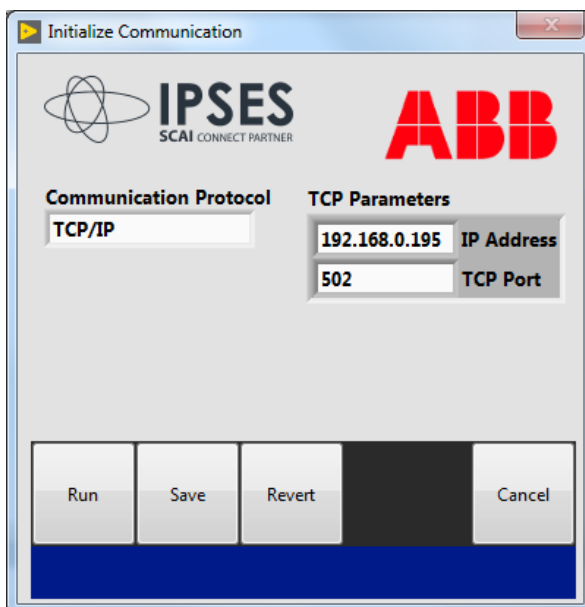
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2.1 Initialize Modbus



The screenshot shows the 'Initialize Communication' dialog box. The 'Communication Protocol' is set to 'Modbus'. The 'Modbus Parameters' section includes: 'Slave Address' (0), 'Baud Rate' (9600), 'Port' (1/0), and 'Parity (Even)'. At the bottom are buttons for 'Run', 'Save', 'Revert', and 'Cancel'.

This Step Type allows to configure and initialize the communication with the DUT; you can choose the communication protocol between Modbus and TCP/IP.



The screenshot shows the 'Initialize Communication' dialog box. The 'Communication Protocol' is set to 'TCP/IP'. The 'TCP Parameters' section includes: 'IP Address' (192.168.0.195) and 'TCP Port' (502). At the bottom are buttons for 'Run', 'Save', 'Revert', and 'Cancel'.


Once the configuration protocol has been chosen, it is possible to set the parameters which change according to the choice. In case the Modbus protocol is selected it is possible to configure the following parameters: Slave Address, Baud Rate, Data Bits, Stop Bit and the

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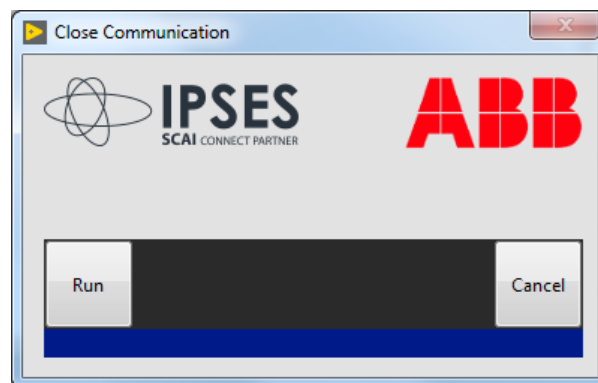
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Parity. If the TCP/IP protocol is selected, it is possible to configure the IP Address and the TCP Port.

The Step Properties additional to the default ones are: **TCPParameters** (a cluster of 2 elements: IP_Address and TCP_Port), **ModbusParameter** (a cluster of 5 elements: Slave_Address, Baud_Rate, Data_Bits, Stop_Bit and Parity) and **CommunicationProtocol** (an enumerative of 2 elements: TCP/IP and Modbus).

2.2 Close Modbus




This Step Type has no configurable parameters in the Edit panel because it serves only to close the communication session with the DUT, it is however possible to perform this operation by clicking on the **RUN** button in the Edit phase.

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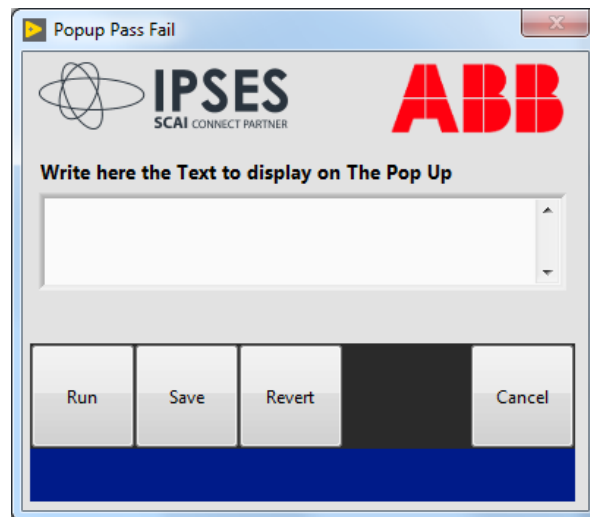
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2.3 Popup PassFail



In the various test cases listed in the "PMD Test Case" document, there is often a need to perform operations checks directly on the HMI, so the test sequence sometimes requires stopping to allow the user to do a visual check on the M4M HMI.

This Step Type allows you to configure in the Edit phase a message that will then appear in the pop-up during test execution or by clicking on the **RUN** button (if you want to debug). The following image shows the pop-up with a preconfigured Text string.

The pop-up window displayed is modal so once you have taken the suggested action, you must click the **PASS** or **FAIL** button to continue running the test.


The only additional Step Property present is **StringToDisplay** that allows to save the value of the string to show in the pop-up.

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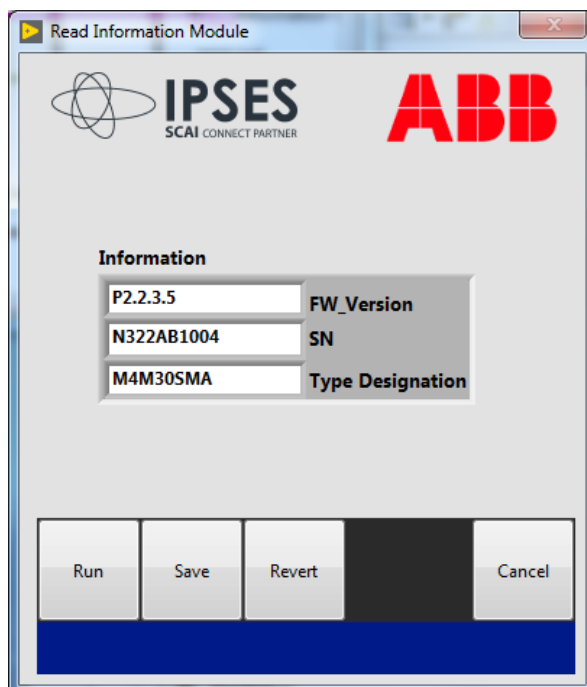
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2.4 Information Module




This Step Type has no configurable parameters in the Edit panel because it is used only to read the Firmware Version, Serial Number and Type Designation of the DUT, you can still perform this operation by clicking on the **RUN** button during the Edit phase.

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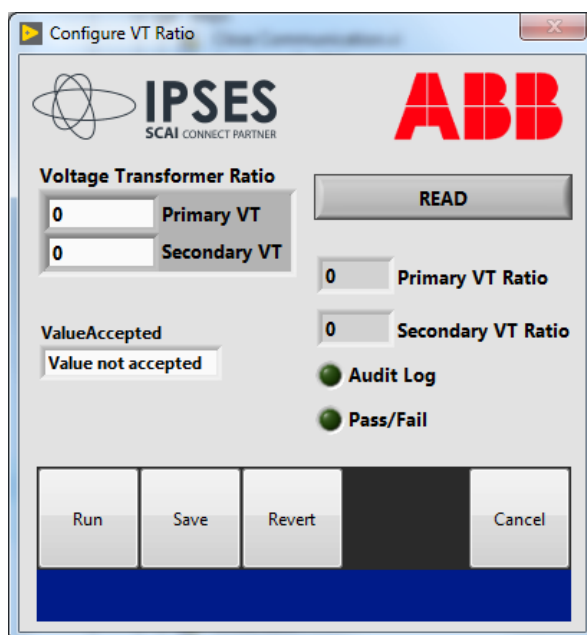
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2.5 Pass/Fail Group

This group includes pass/fail step types

2.5.1 Configure Voltage Transformer Ratio



With this Step Type it is possible to configure primary and secondary Voltage Transformer Ratio and if the value is acceptable or not (**ValueAccepted**). Through the **READ** button it is possible to read again the parameters to verify correct writing. Boolean indicator Audit Log indicates the match between the values of the log and those configured.

It is worth noting that, during the execution of the step, only the setting of the Primary VT, Secondary VT and Value Accepted parameters takes place (and not the read), that is the function that is executed with the **RUN** button.


The additional Step Properties of this Step Type are: **VoltageTransformerRatio** (cluster of 2 elements PrimaryVT and SecondaryVT), **PrimaryVTRegister**, **SecondaryVTRegister** and **AuditLog**. The last 3 are used to read back the registers via the **Read** command.

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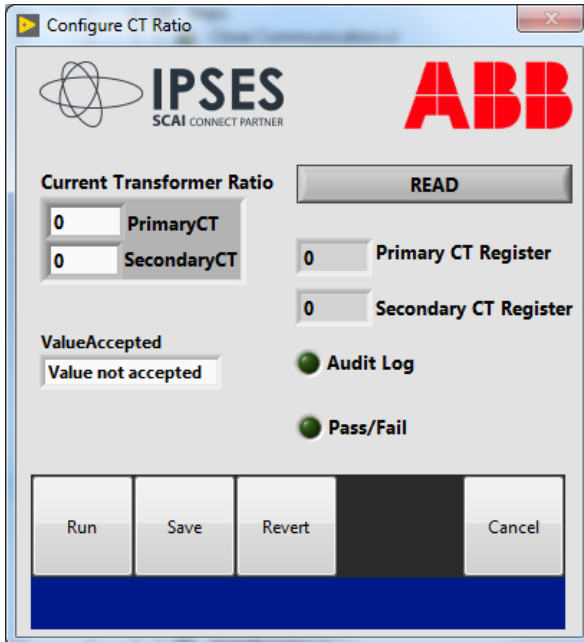
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2.5.2 Configure Current Transformer Ratio



With this Step Type it is possible to configure the primary Current Transformer Ratio, the secondary Current Transformer Ratio and whether the value is acceptable or not (**ValueAccepted**). In addition, through the **READ**, the reading of the parameters takes place in order to verify correct writing. Boolean value of the Audit Log indicates the match between the values of the log and those set.

Like **Voltage Transformer Ratio** step, it is worth noting that when the step is executed, only the Primary CT, Secondary CT and Value Accepted parameters are set, while the read operation takes place using **RUN** button.


The additional Step Properties of these Step Types are: **CurrentTransformerRatio** (clusters of 2 elements PrimaryVT and SecondaryVT, the latter can only be configured with values 0 and 5), **PrimaryCTRegister**, **SecondaryCTRegister** and **AuditLog**. The last 3 are used to read the logs via the **Read** command.

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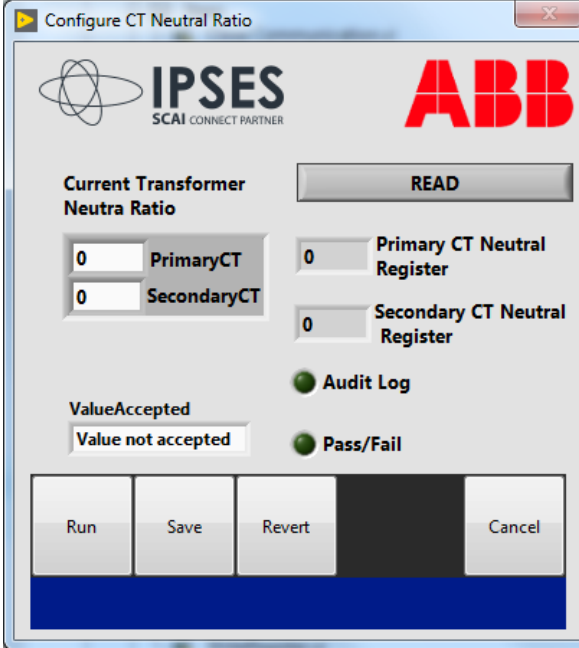
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2.5.3 Configure Current Neutral Transformer Ratio



With this Step Type it is possible to configure primary and secondary Current Neutral Transformer Ratio and if the value is acceptable or not acceptable (**ValueAccepted**). Furthermore, through the **READ**, the reading of the parameters takes place in order to verify correct writing. Boolean indicator Audit Log indicates the match between the values of the log and those set.

Like **Voltage Transformer Ratio** and **Current Transformer Ratio** step, it is worth noting that when the step is executed, only the Primary CT, Secondary CT and Value Accepted parameters are set, while the read operation takes place using **RUN** button.


The additional Step Properties of this Step Type are: **CurrentNeutralTransformerRatio** (cluster of 2 elements PrimaryVT and SecondaryVT, the latter can only be configured with values 0 and 5), **PrimaryCTRegister**, **SecondaryCTRegister** and **AuditLog**. The last 3 are used to read the logs through the **Read** command.

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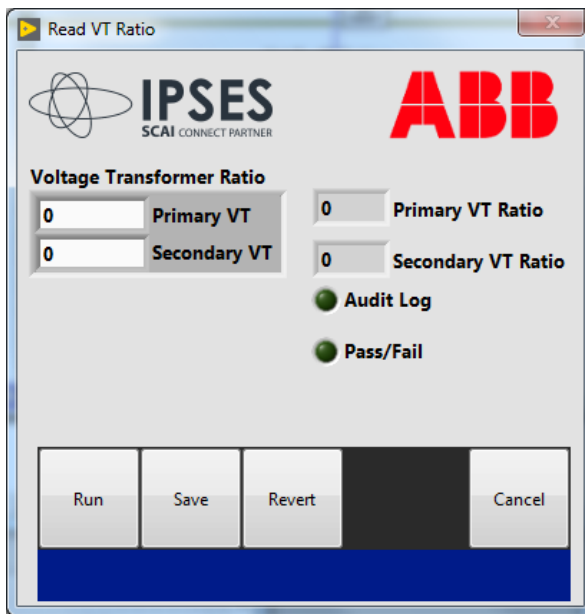
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2.5.1 Read Voltage Transformer Ratio




With this Step Type it is possible to read the primary and secondary Voltage Transformer Ratio verifying that the value is equal to the desired (**Voltage Transformer Ratio**). The output of the step type is a Boolean **pass/fail** that identifies good execution of the measure. Boolean value Audit Log indicates the match between the values of the log and those read.

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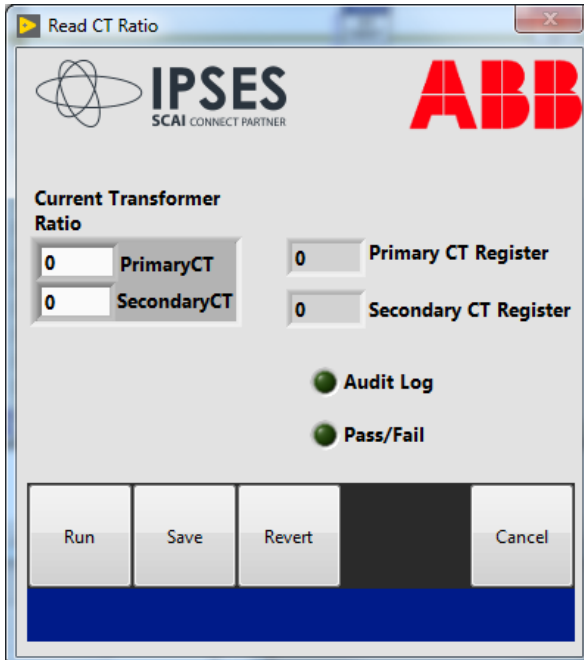
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2.5.2 Read Current Transformer Ratio




With this Step Type it is possible to read the Current Transformer Ratio verifying that the value is equal to the desired (**Current Transformer Ratio**). The output of the step type is a Boolean **pass/fail** that identifies good execution of the measure. Boolean value Audit Log indicates the match between the values of the log and those read.

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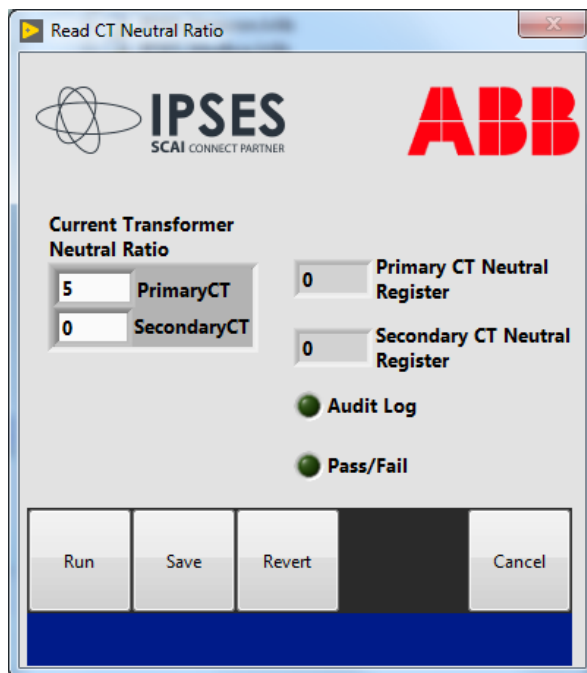
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2.5.3 Read Current Neutral Transformer Ratio




With this Step Type it is possible to read the primary and secondary Current Transformer Neutral verifying that the value is equal to the desired (**Current Transformer Ratio**). The output of the step type is a Boolean **pass/fail** that identifies good execution of the measure. Boolean value Audit Log indicates the match between the values of the log and those read.

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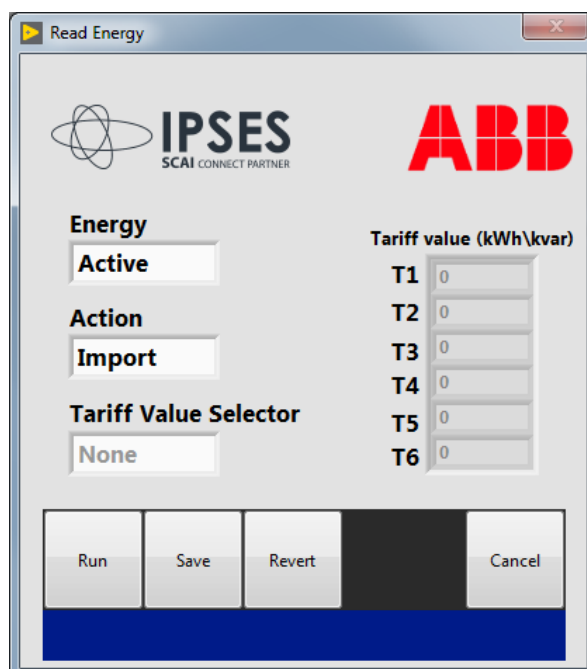
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2.6 Read Group

This group includes data reading Step Types.

2.6.1 Read Energy



With this Step Type it is possible to read the energy value of the different tariffs and of the selected tariff (**TariffValue Selector**).


It is worth noting that in the step configuration phase, it is possible to configure the type of Energy (Active or Reactive by means of the **Energy** item) the direction (Imported or Exported by means of the **Action** item) and the tariff whose energy you want to know (**Tariff Value Selector**).

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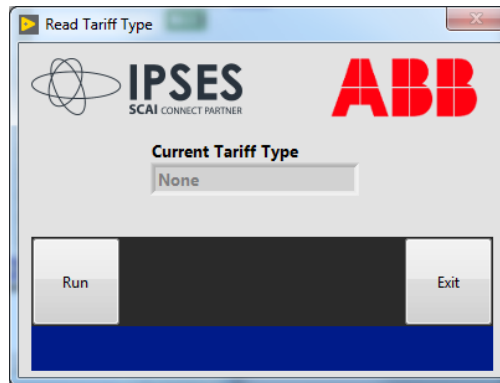
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	Code: Revision: Date:	ABB M4M Rel 02.04.000 07/03/2022	

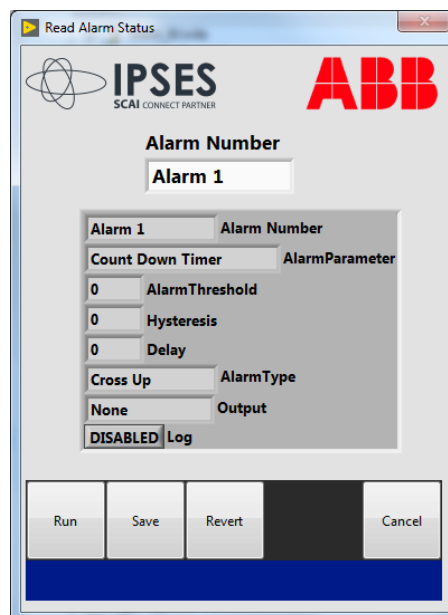
2.6.2 Read Current Tariff



This Step Type allows to read the type of Tariff currently set. Since it is a read-only step, only the **RUN** and **CANCEL** commands are present.

The additional Step Property is **CurrentTariffType** an Enum containing the various selectable Tariff types and the case None.

2.6.3 Read Alarm




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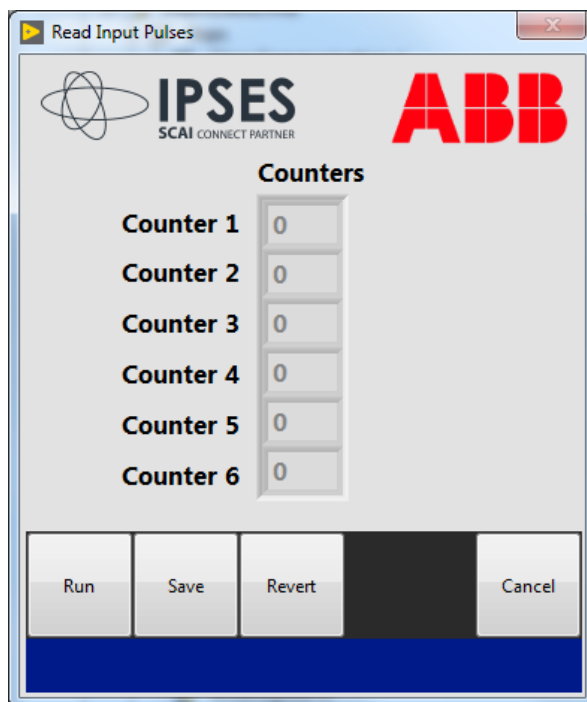
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With this Step Type it is possible to read the value and the state of the Alarm parameters. Since it is only a reading step, there are no parameters to configure, so there are no **SAVE** and **CANCEL** commands.

The additional Step Property of this Step Type is the same as the Step Type **Configure Alarm**, that is the **AlarmSetting** cluster.

2.6.4 Read Input Pulses



This Step Type allows the reading of the Pulse count at the input to the DUT.


The Step Property **Counters** saves counters' values when the step is executed.

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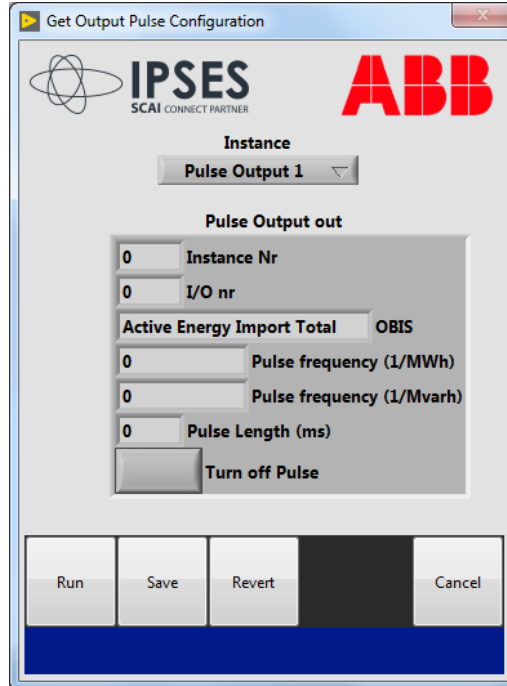
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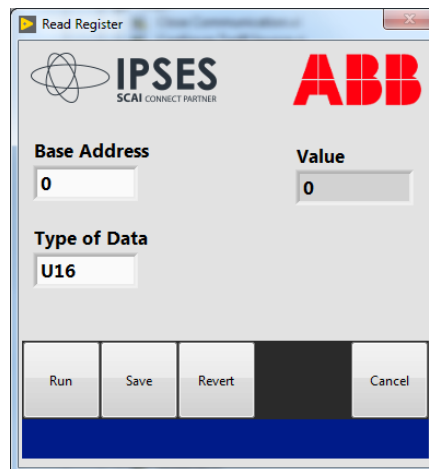
	Customer:	ABB S.p.A.	23/79
	Document	CUSTOM STEP TYPES DESCRIPTION FOR ABB M4M	
	Code: Revision: Date:	ABB M4M Rel 02.04.000 07/03/2022	

2.6.5 Get Output Pulse Configuration



With this Step Type it is possible to read the Output Pulse settings using the **Instance** item.

2.6.6 Read Register




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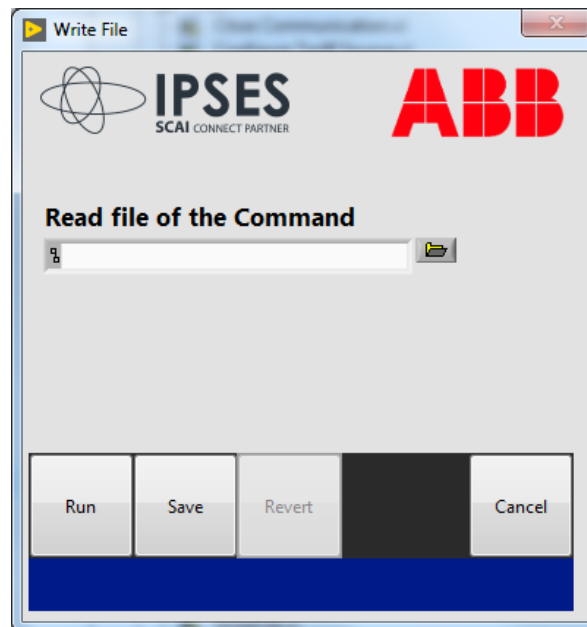
VAT code: 03999740966 - Tel. (+39) 02 39449519 – Fax (+39) 02 700403170 e-mail: info@ipses.com – <https://www.ipses.com>

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	Document	CUSTOM STEP TYPES DESCRIPTION FOR ABB M4M	
	Code: Revision: Date:	ABB M4M Rel 02.04.000 07/03/2022	

This Step Type allows to read a generic register via an address (you must also specify the length of the data in number of bytes), the address must be expressed in hexadecimal.

The additional Step Properties are **BaseAddress** (the base address of the register to be read), **Length** (the length in bytes of the data to be read) and **RegisterValue** (the value read in the register).

2.6.7 Read Command File



This Step Type allows you to write data to M4M from file.

The additional Step Propertie of this Step Type is **Read File of the command** that is the path of the file with all the instructions to be executed.

The command execution file is composed of 3 columns

- The **Address** column where the address of the command in Hexadecimal is entered
- The column **Data (Hex)** where you insert the data to import (the hexadecimal value) on the M4M
- The **comment** column where any comments are present


Below an example of the file is shown

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	Document	CUSTOM STEP TYPES DESCRIPTION FOR ABB M4M	
	Code: Revision: Date:	ABB M4M Rel 02.04.000 07/03/2022	

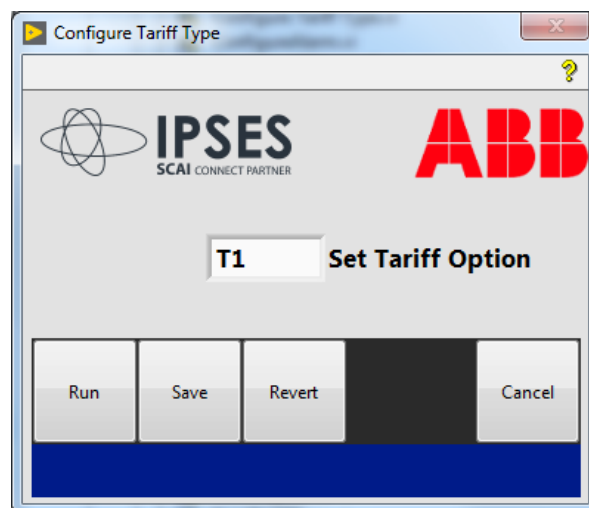
;Address	Data (Hex)	Comment
;Allarm 2		
8C60	0001	Channel alarm number
8C61	0100200700FF OBIS	
8C64	00000000000000064	Threshold
8C68	000A	Hysteresis
8C69	0000000A	Delays
8C6B	0002	Type of alarm
8C6C	00070003	Action - alarm triggered

It is worth noting that semicolon ";" comments the line and therefore the instruction is not executed

2.7 Write Group

Data Writing Step Types belong to this group.

2.7.1 Configure Current Tariff



This Step Type allows to set the Rate Type.


The only additional Step Property is Set **Tariff Option**, an Enum of 6 elements: T1, T2, T3, T4, T5, T6.

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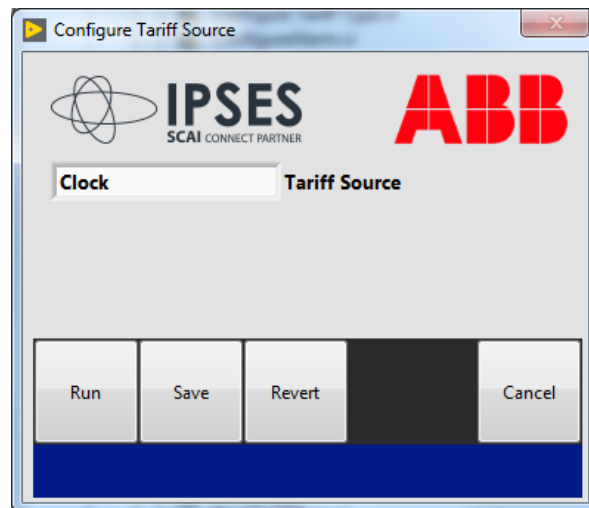
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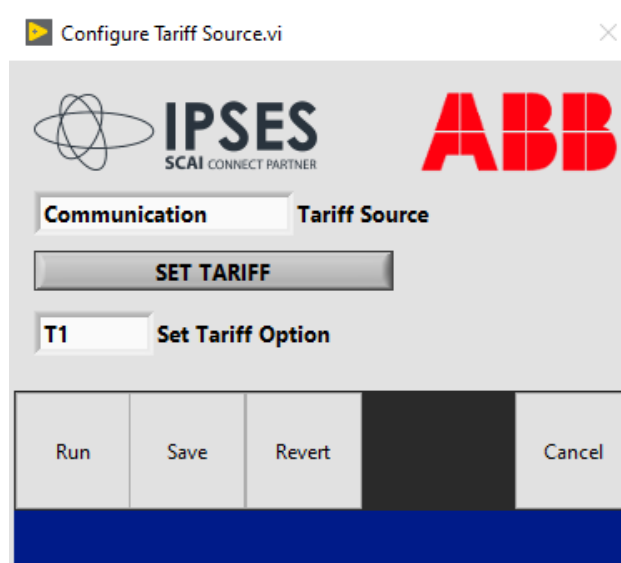
	Customer:	ABB S.p.A.	26/79
	Document	CUSTOM STEP TYPES DESCRIPTION FOR ABB M4M	
	Code: Revision: Date:	ABB M4M Rel 02.04.000 07/03/2022	

2.7.2 Configure Tariff Source



With this Step Type it is possible to configure Source Tariff with one of the values between "Communication", "Clock" and "Input". If the "Communication" value is selected, it is also possible to directly configure the Tariff type.

The only additional Step Property is **TariffSource**, an Enum of 3 elements: Clock, Input and Communication




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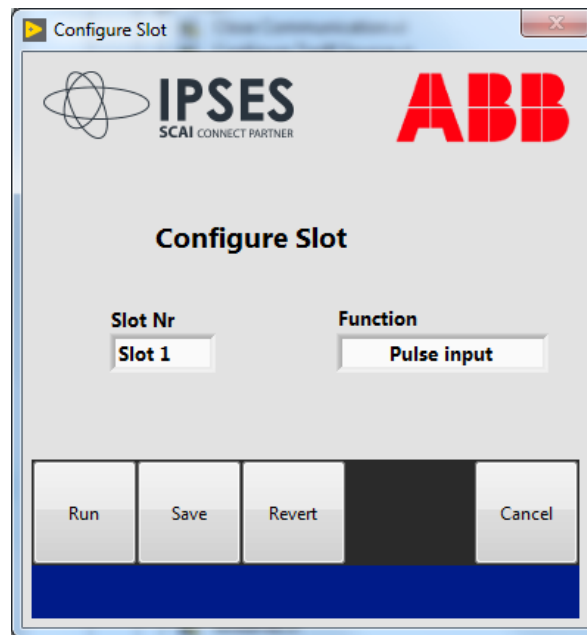
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The **SET TARIFF** button is used to write the tariff type, but this operation is not performed at runtime (*i.e.*: using the **RUN** button or by executing the test sequence).

2.7.3 Configure Slot




This Step Type allows to configure the 6 outputs (**Slot Nr**) of the M4M DUT separately. The selectable configurations (**Function**) are: Output Always OFF, Output Always ON, Tariff Input, Pulse Output, Alarm Output, Communication Output, Pulse Input.

IPSES s.r.l.

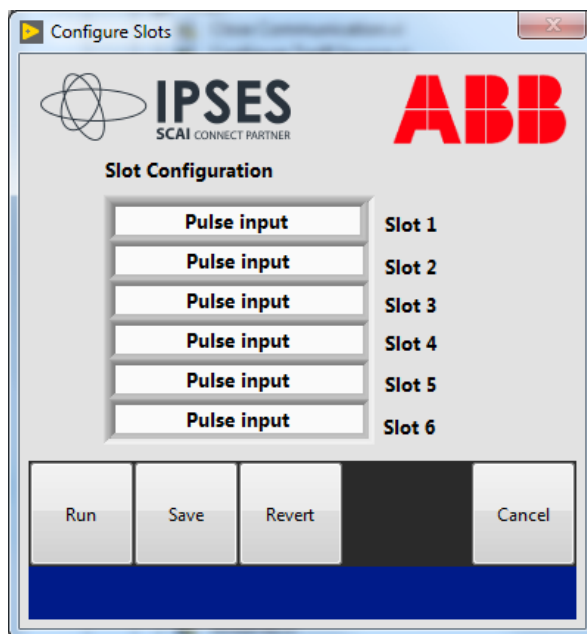
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2.7.4 Configure Slots



This Step Type allows to configure the 6 outputs (Slots) of the M4M DUT. The selectable configurations are not the same for all slots.

For slots 1,2,3 allowed configurations are: Output Always OFF, Output Always ON, Tariff Input, Pulse Output, Alarm Output, Communication Output, Pulse Input.

For slots 4,5,6 allowed configurations are all those of the first three slots except "Tariff Input": Output Always OFF, Output Always IN, Pulse Output, Alarm Output, Communication Output, Pulse Input.


In addition to the default Step Properties there is another property: **SlotConfiguration** a cluster of 6 elements in which the first 3 allow the selection of all possible configurations and the last 3 allow the selection of all configurations except "Tariff Input".

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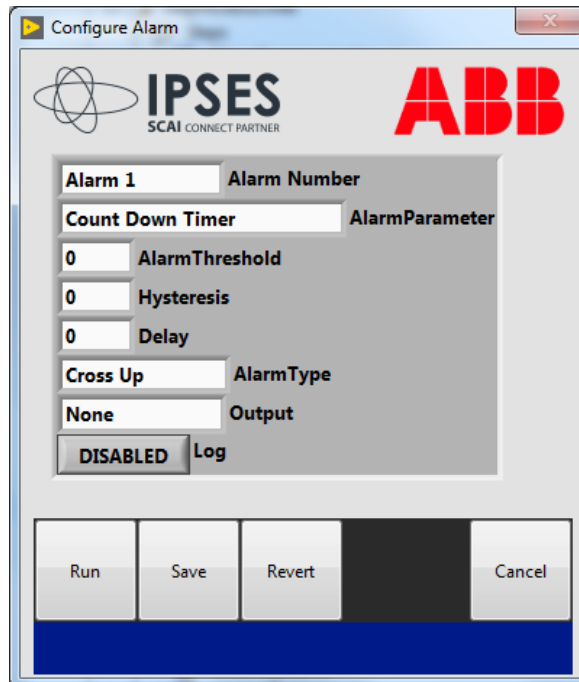
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2.7.5 Configure Alarm



This Step Type allows you to configure an Alarm. It is possible to configure the following parameters:

- Alarm Number: values ranging from "Alarm 1" to "Alarm 25"
- Alarm Paramter: values are Voltage (L1, L2, L3), Current (L1, L2, L3), Active Power (L1, L2, L3), Reactive Power (L1, L2, L3), Frequency, THD Voltage (L1, L2, L3), THD Current (L1, L2, L3), Power Factor, Count Down Timer, Unbalance Voltage, Apparent Power.
- Alarm Type: values are Cross Up e Cross Down
- Output: it is possible to choose one of 6 outputs.


The Step Property is **AlarmSetting**, a cluster of 8 elements that correspond to the parameters that can be configured in Edit: AlarmNumber, AlarmParameter, AlarmThreshold, Hysteresis, Delay, AlarmType, Output, Log.

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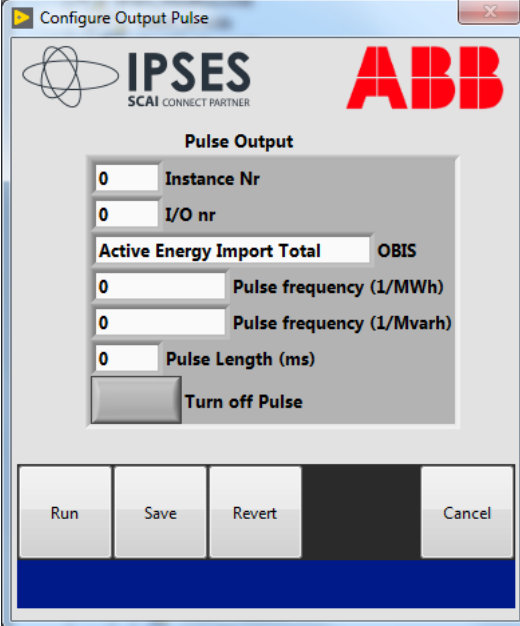
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2.7.6 Set Output Pulse Configuration



With this Step Type, you can configure the Output Pulse settings by selecting Power Under Consideration (**OBIS**), **Pulse Frequency** and **Pulse Length**.


The Pulse Output is turned off by clicking on the **Turn off Pulse** control.

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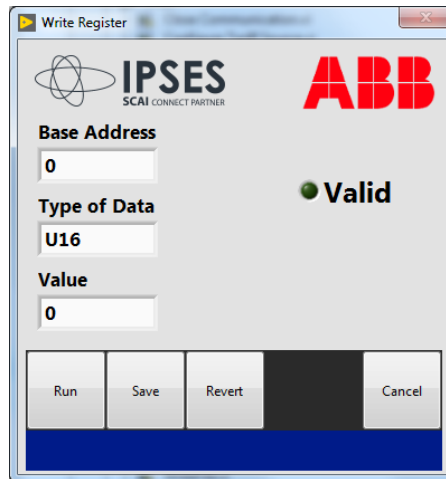
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2.7.7 Write Register



This Step Type allows to write a value into a generic register using a base address (you must also specify the length of the data to be written in number of bytes). There is also a boolean that will confirm the writing in the register without errors.


The additional Step Properties of this Step Type are **BaseAddress** (the base address of the register to be written), **Length** (the length in bytes of the data to be written), **RegisterValue** (the value written to the register), and the boolean **Valid** which indicates whether the write was successful.

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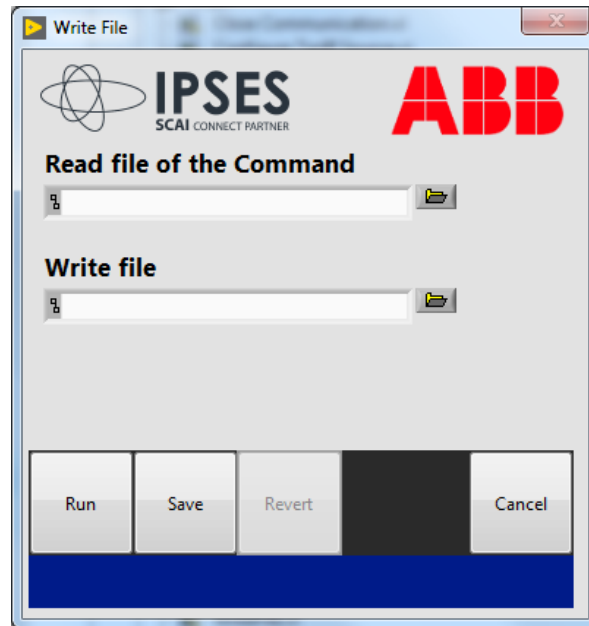
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2.7.8 Write File Command



This Step Type allows you to download all the data from the M4M to a file.

The additional Step Properties of this Step Type are **Read File of the command** which is the path to the file with all the commands to be sent to the M4M and **Write File** which is the path of the write file.

The command file consists of 3 columns

- The **Address** column where the address of the command is entered in Hexadecimal.
- The **Size** column with the length of the registers to read
- The **comment** column for the comments

Below there is an example of a command file


;Address	Size	Comment
;Alarm 2		
8C60	1	Channel alarm number
8C61	3	OBIS
8C64	4	Threshold
8C68	1	Hysteresis
8C69	2	Delays
8C6B	1	Type of alarm

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	Code: Revision: Date:	ABB M4M Rel 02.04.000 07/03/2022	

8C6C 2 Action - alarm triggered

The command file including the read data is composed of 4 columns

- The **Address** column where the address of the command is present (Hexadecimal)
- The **Size** column is the length of the register
- The column **Data (Hex)** is the value read from the corresponding register (the value is in hexadecimal)
- The comment column hosts comments

Below there is an example of the file

;Address	Size	Data (Hex)	Comment
;Alarm 2			
8C60	1	0001	Channel alarm number
8C61	3	0100200700FF	OBIS
8C64	4	0000000000000064	Threshold
8C68	1	000A	Hysteresis
8C69	2	0000000A	Delays
8C6B	1	0002	Type of alarm
8C6C	2	00070003	Action - alarm triggered


It is worth noting that semicolon ";" comments the line and therefore the instruction is not executed

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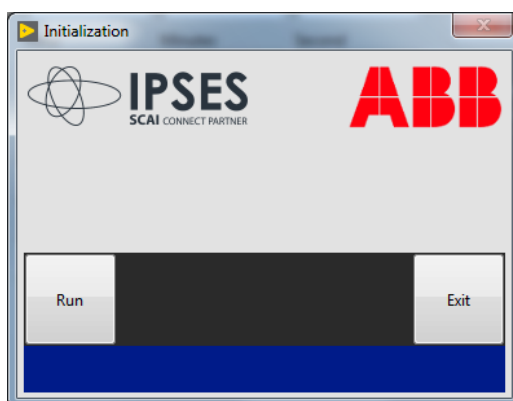
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3 OMICRON STEP TYPE

In this chapter the custom step types for the configuration of inputs and outputs of the Omicron instrument via NI-TestStand are described in brief. The principle of operation of **RUN**, **SAVE**, **CANCEL** and **REVERT** controls in the Edit panel is the same as the custom step types of M4M communication.

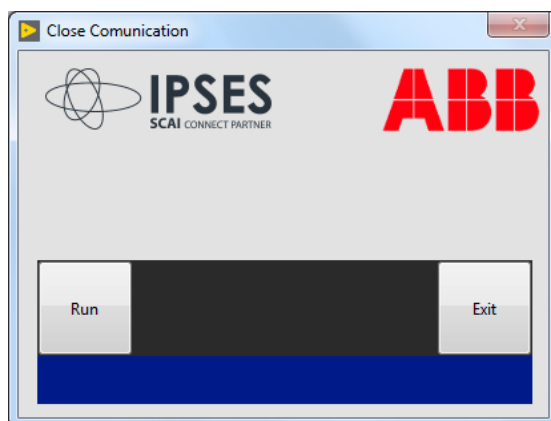
3.1 Initialize Omicron



This Step Type has no configurable parameters in the Edit panel because it is used to Initialize the communication session with the Omicron, it is however possible to perform this operation by clicking on the **RUN** button during the Edit phase.

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3.2 Close Omicron




This Step Type has no configurable parameters in the Edit panel because it is used only to close the communication session with the Omicron, you can still perform this operation by clicking on the **RUN** button in the Edit phase.

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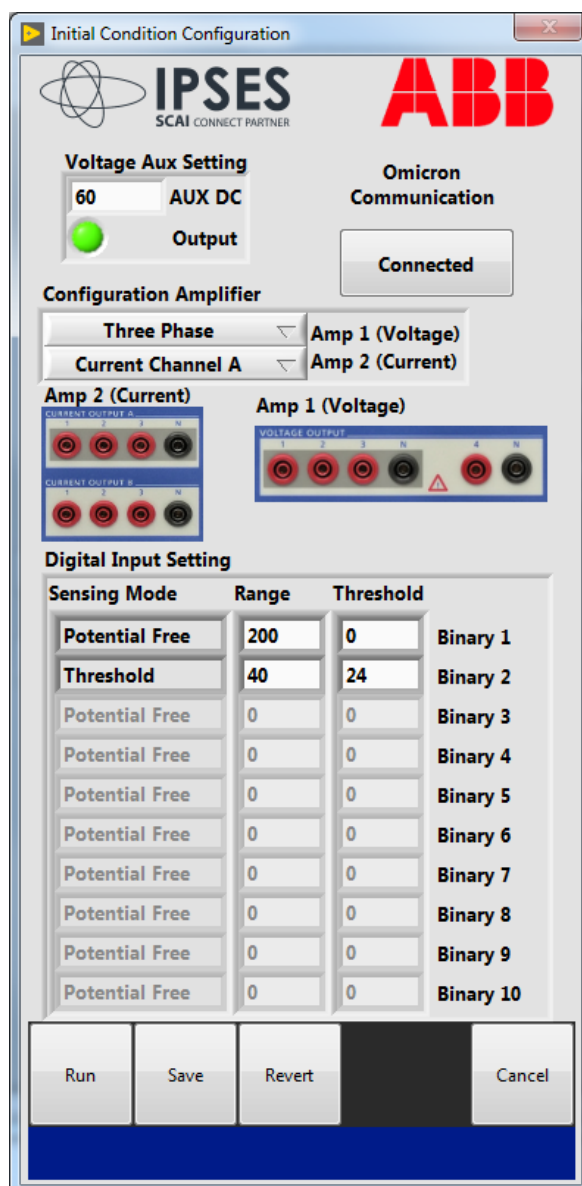
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	Code: Revision: Date:	ABB M4M Rel 02.04.000 07/03/2022	

3.3 Configure

All configuration step types are part of this step type group.

3.3.1 Initial Condition



Initial Condition Configuration

IPSES SCAI CONNECT PARTNER **ABB**

Voltage Aux Setting
60 AUX DC Output

Omicron Communication
Connected

Configuration Amplifier
Three Phase
Current Channel A

Amp 2 (Current)
CURRENT OUTPUT A
CURRENT OUTPUT B

Amp 1 (Voltage)
VOLTAGE OUTPUT

Digital Input Setting

Sensing Mode	Range	Threshold	
Potential Free	200	0	Binary 1
Threshold	40	24	Binary 2
Potential Free	0	0	Binary 3
Potential Free	0	0	Binary 4
Potential Free	0	0	Binary 5
Potential Free	0	0	Binary 6
Potential Free	0	0	Binary 7
Potential Free	0	0	Binary 8
Potential Free	0	0	Binary 9
Potential Free	0	0	Binary 10


Run Save Revert Cancel

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	Document	CUSTOM STEP TYPES DESCRIPTION FOR ABB M4M	
	Code: Revision: Date:	ABB M4M Rel 02.04.000 07/03/2022	

This Step Type allows to set the initial configuration of the Omicron with particular attention to the configuration of the auxiliary output (**Voltage Aux Setting**), the amplifiers (**Amplifier Configuration**) and the digital inputs (**Digital Input Setting**).

All the items in the Type step will be explained one by one below.

Voltage Aux Setting allows to set the auxiliary voltage using the **AUX DC** control and to enable the **output** using the Boolean Output.

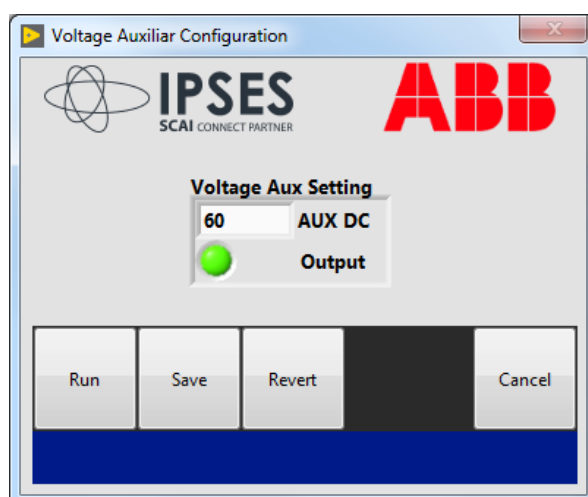
Configuration Amplifier allows to configure the two front amplifiers of the Omicron via drop-down menus.

Digital Input Setting allows to configure the input digits by selecting the type of Sensing Mode (Potential Free or Threshold), the measuring Range and the Threshold.

Omicron Communication allows to select whether the configuration takes place offline by simulating the Omicron (**Simulated**) or online (**Connected**).

The Omicron Communication switch is in **Connected** state during the Run phase.

3.3.2 Configure V Aux




This Step Type allows to set the configuration of the auxiliary output (**Voltage Aux Setting**).

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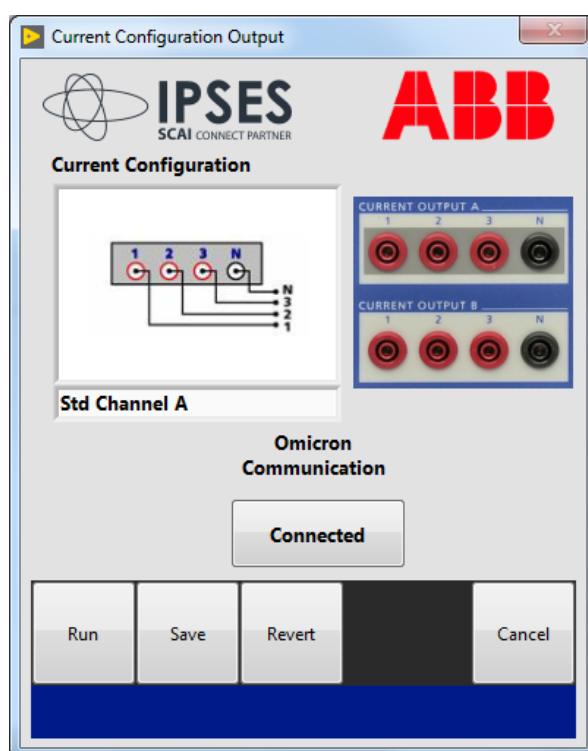
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As already described in the previous step (**Initial condition**) the step type consists of a **Voltage Setting** cluster that allows to set the auxiliary voltage (**AUX DC**) and to enable it through the Boolean **Output**.

3.3.3 Current Configuration



The following Step Type allows to set the Current Amplifier configuration using the **Current Configuration** selector among the seven possible configurations (Std Channel A, Std Channel B, Par3, Ser3, Ser4, SerPar and Par2Ser2).

As for the step type **Initial condition**, **Omicron Communication** allows to select offline simulation of Omicron (**Simulated**) or online communication (**Connected**).


When the step type is executed (Run type phase), the Omicron Communication is always in **Connected** state.

IPSES s.r.l.

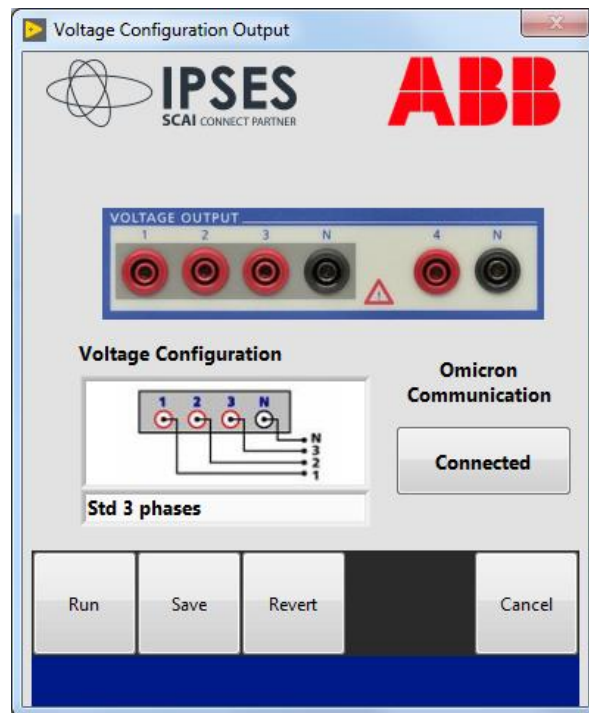
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3.3.4 Voltage Configuration



The following Step Type allows to set the configuration of the Current Amplifier using the **Voltage Configuration** selector among the five possible configurations (Std 3 phases, Std 1 phase (4N), Zero, Ser13, Ser2).

As for the step type **Initial condition**, **Omicron Communication** allows to select offline simulation of Omicron (**Simulated**) or online communication (**Connected**).


When the step type is executed (Run type phase), the Omicron Communication is always in **Connected** state.

IPSES s.r.l.

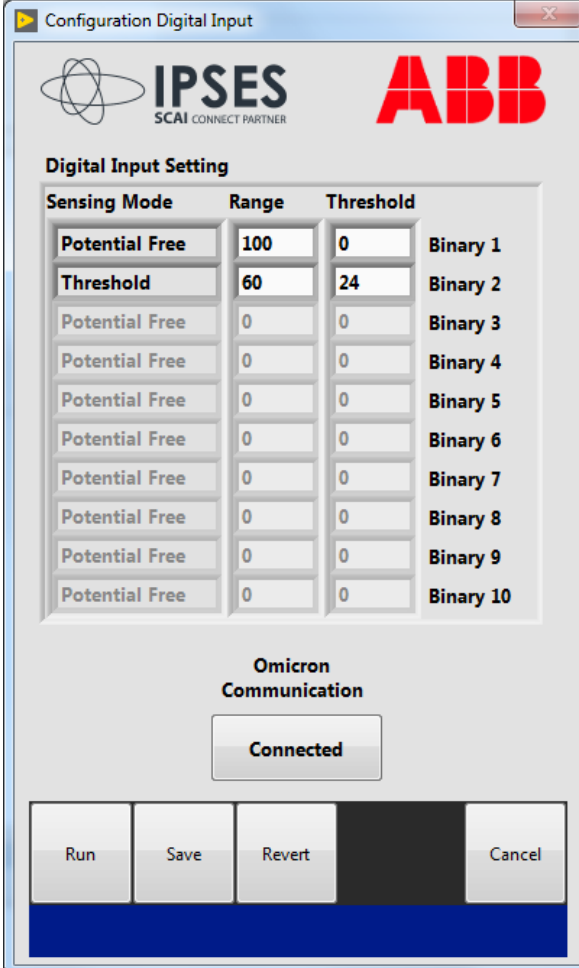
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3.3.5 Digital Input Configuration



Sensing Mode	Range	Threshold	
Potential Free	100	0	Binary 1
Threshold	60	24	Binary 2
Potential Free	0	0	Binary 3
Potential Free	0	0	Binary 4
Potential Free	0	0	Binary 5
Potential Free	0	0	Binary 6
Potential Free	0	0	Binary 7
Potential Free	0	0	Binary 8
Potential Free	0	0	Binary 9
Potential Free	0	0	Binary 10

Omicron Communication

Connected

Run Save Revert Cancel

This Step Type allows to set the configuration of the digital inputs.

As for the step Type **Initial Conditioning**, the **Digital Input Setting** cluster allows to Configure the Digital input selecting the type through **Sensing Mode** (Potential Free or Threshold), the **Range** of measure and the **Threshold**. Furthermore, **Omicron Communication** allows to select offline simulation of Omicron (**Simulated**) or online communication (**Connected**).


When the step type is executed (Run type phase), the Omicron Communication is always in **Connected** state.

IPSES s.r.l.

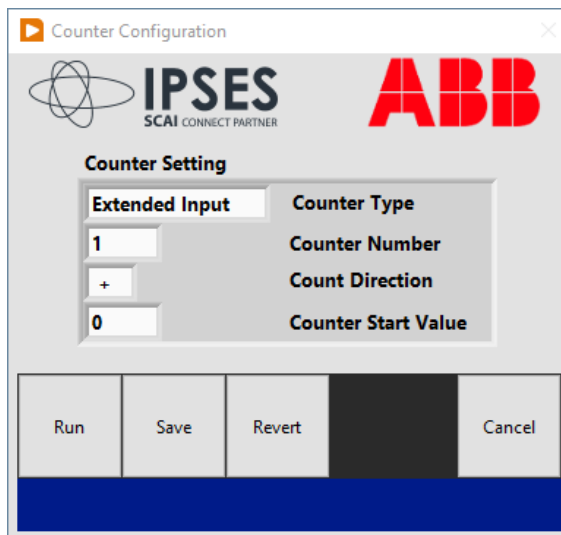
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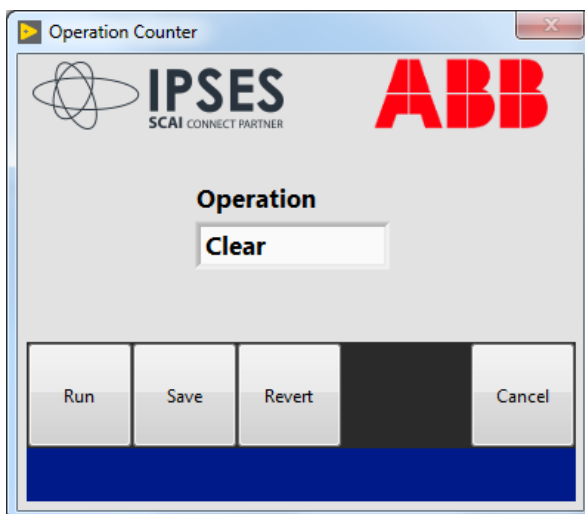
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3.3.6 Configure Counter



This Step Type set the configuration for input counters. “**Counter Type**” drop down menu set the type of the counter (between “Binary input” and “Extended Input”), “**Counter Number**” set the number for the counter, “**Counter Direction**” set the counting direction and “**Counter Start Value**” set the starting number for the counter.

3.3.7 Operation on the Counter




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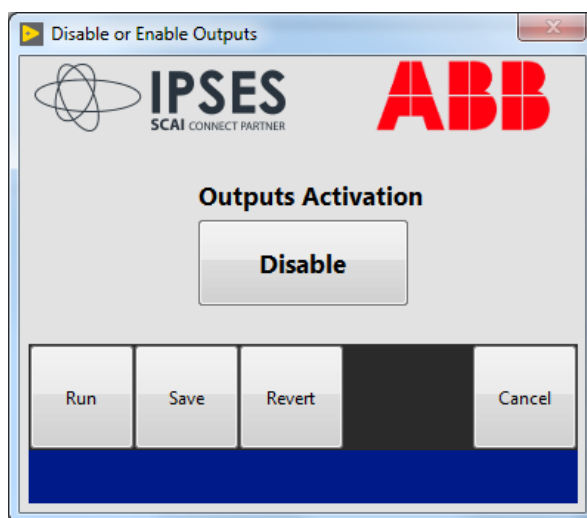
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The Step Type allows to **Clear**, **Start** and **Stop** the previously enabled counters.

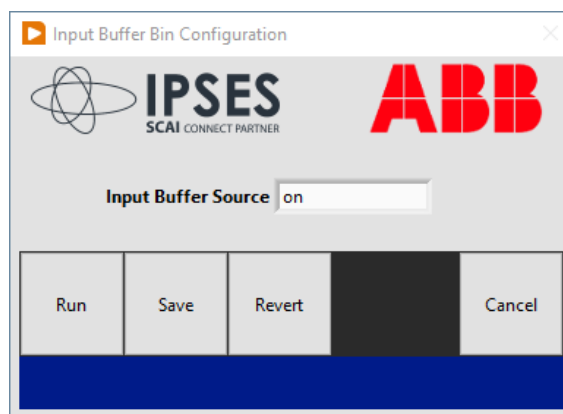
It is worth noting that this Step Type is a subordinate to the Counter Configuration step type.

3.3.8 Enable/Disable Outputs



The following Step Type allows to enable or disable all analog outputs using the **Outputs Activation** button.

3.3.9 Configure Input Buffer Bin




This Step Type allow to turn automatic logging of changes ON or OFF on the binary inputs. Running the step executes the instruction "*inp:buf:sam (bin, x)*", where **x** is chosen between the options contained in the drop down menu "**Input Buffer Source**" (on, off, 1, 2, 3, 4, 5, 6, 7, 8, 9).

IPSES s.r.l.

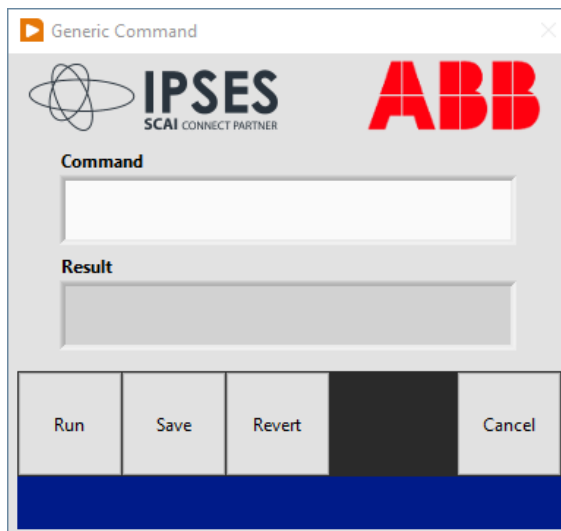
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3.3.10 Generic Command



This Step Type is used to send a custom string "**Command**" directly to Omicron and to get back the answer in the "**Result**" string indicator. In Edit phase, it is possible to define any string command to send during the Run. The answer by Omicron will populate ResultString in Step parameters.

3.3.11 Clear Input Buffer


This step has no Edit panel and during the Run it executes the instruction "*inp:buf:clr*" that clears the buffer for all measurement data.

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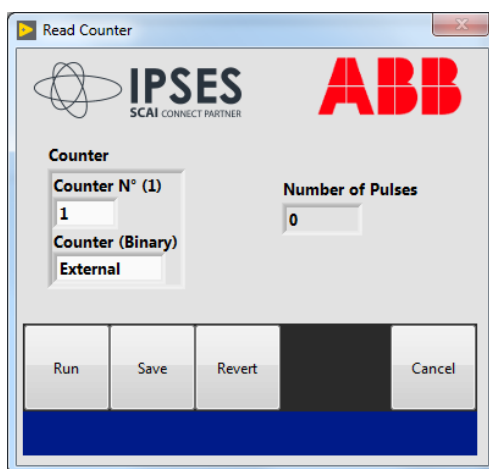
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3.4 Acquire

Input signal acquisition step types are part of this group.

3.4.1 Read Counter




The Step Type allows to read the number of pulses counted by the counter (**Number of Pulses**) selected by the Cluster **Counter**.

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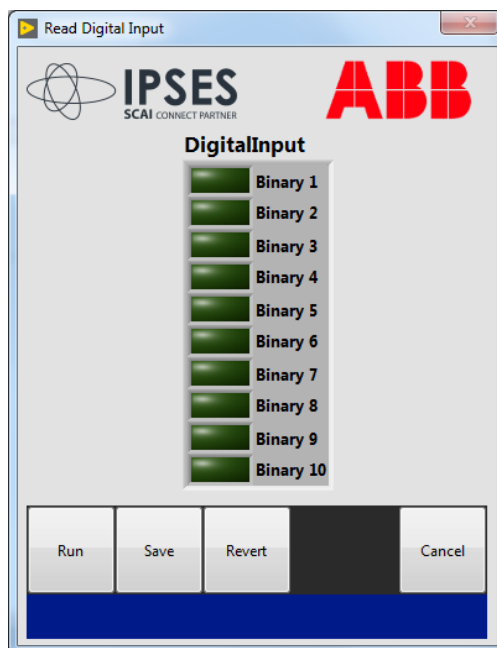
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3.4.2 Read Digital Input



By means of this Step Type it is possible to acquire the status of the Input Digits.


Note that the size of the digital input array varies according to the number of digital inputs that have been previously enabled with one of the two configuration step types (**Digital Input Configuration** or **Initial Condition**); therefore, this step type is subordinate to the above-mentioned step types.

IPSES s.r.l.

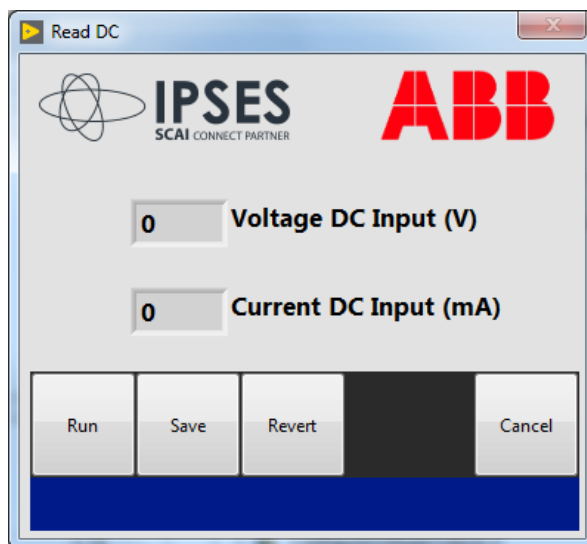
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3.4.3 Read DC



This Step Type allows to read the value of Continuous signals.


The first channel **Voltage DC Input (V)** is able to read a voltage signal (0-10 V) while the second channel **Current DC Input (mA)** is able to read a current signal (0-20 mA).

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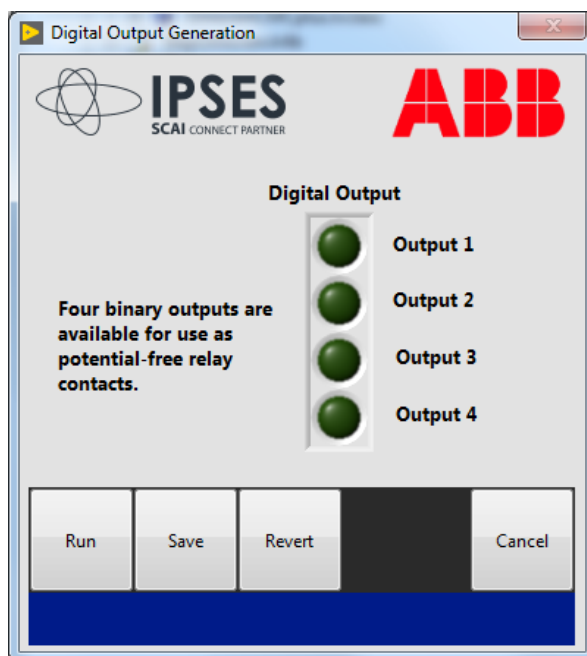
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3.5 Generate

All signal generation step types belong to this group of step types.

3.5.1 Generate Digital Output




This Step Type allows to activate or deactivate the 4 Digital Outputs of the OMICRON by clicking on the **Digital Output** LED array.

IPSES s.r.l.

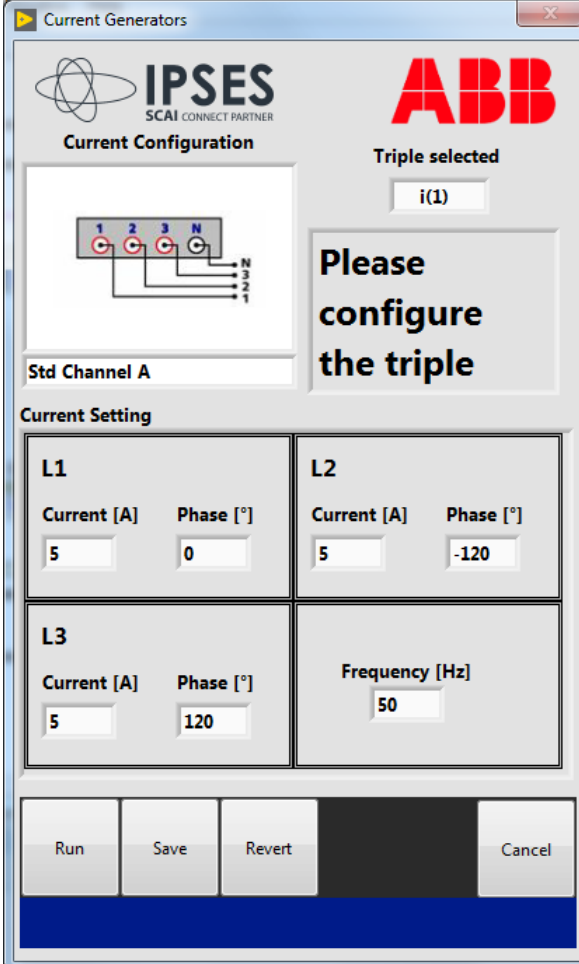
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3.5.2 Generate Current



Current Generators

IPSES SCAI CONNECT PARTNER

Current Configuration

Triple selected

i(1)

Please configure the triple

Std Channel A

Current Setting

L1	L2	L3	Frequency [Hz]
Current [A]: 5	Current [A]: 5	Current [A]: 5	50
Phase [°]: 0	Phase [°]: -120	Phase [°]: 120	

Run Save Revert Cancel

This Step Type you to configure the generation of the current(s) of a **Triple selected**.


The configuration of the above-mentioned current(s) is done by compiling the **Current Setting** cluster in which the currents and phases of the individual output lines and the generation frequency of all lines are set.

IPSES s.r.l.

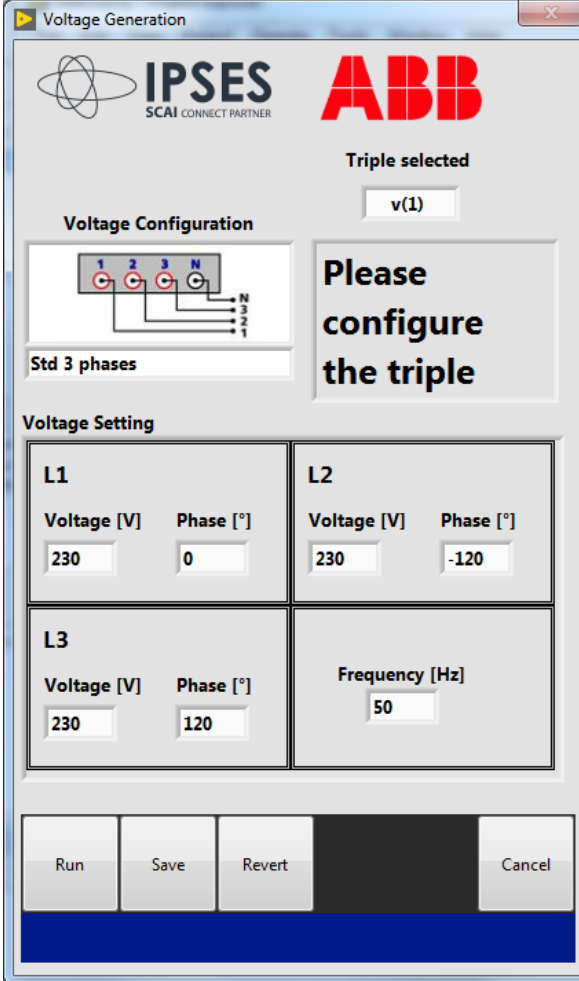
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3.5.3 Generate Voltage



Voltage Generation

IPSES SCAI CONNECT PARTNER ABB

Triple selected

v(1)

Voltage Configuration

Std 3 phases

Please configure the triple

Voltage Setting

L1 Voltage [V] 230 Phase [°] 0	L2 Voltage [V] 230 Phase [°] -120
L3 Voltage [V] 230 Phase [°] 120	Frequency [Hz] 50

Run Save Revert Cancel

This Step Type allows to configure the generation of the voltage(s) of a particular triple (**Triple selected**).


The configuration of the above-mentioned voltage(s) is done by compiling the **Voltage Setting** cluster in which the voltages and phases of the individual output lines and the generation frequency of all lines are set.

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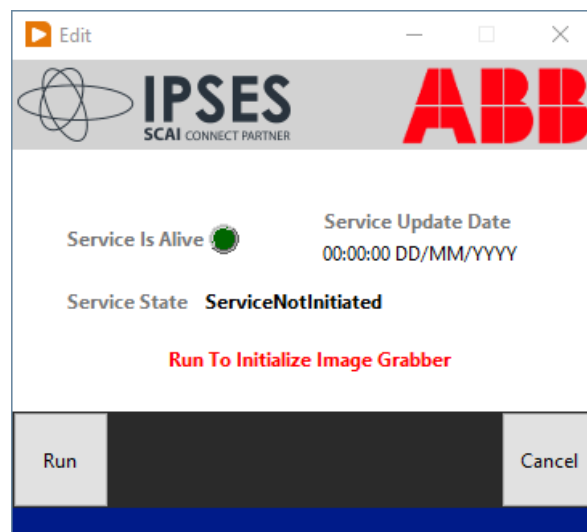
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4 CUSTOM STEP TYPES HMI M4M (ImageTesting)

In this chapter the step types for acquiring and analyzing the HMI screens of the M4M product, using NI-TestStand, are briefly described. The working principle of **RUN**, **SAVE**, **CANCEL** and **REVERT** controls in the Edit panels is the same of the custom step types presented previously.

The acquisition system is based on a background service that “sniffs” the data processed by the display and reconstructs the images, emulating the graphics chipset.

4.1 Image Grabber Init




This Step Type has no configurable parameters in the Edit panel since it serves to Initialize the data acquisition and processing session towards the display. However, it is possible to perform this operation by clicking on the **RUN** button during the Edit phase.

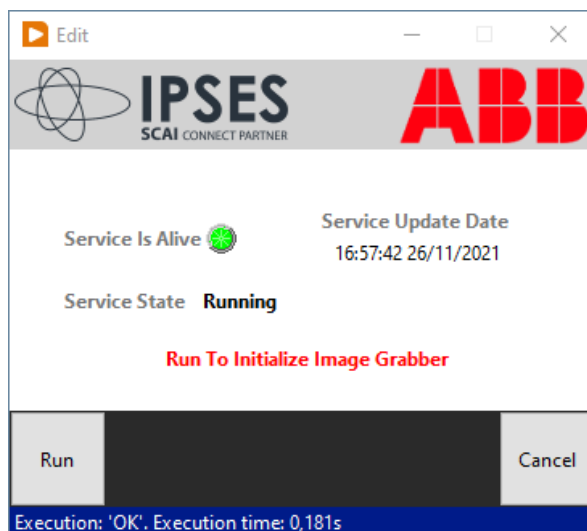
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Service Is Alive indicates whether the Image Grabber service is operational (light green LED).

Service Update Date indicates the date of the last status update of the "Image Grabber" service.


Service State indicates the status of the Image Grabber service.

IPSES s.r.l.

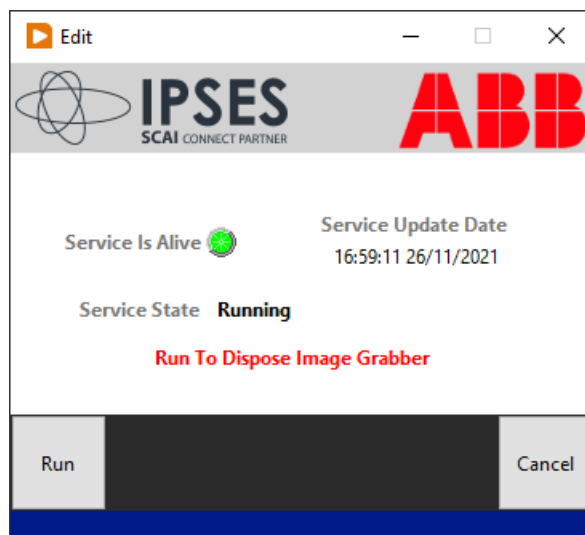
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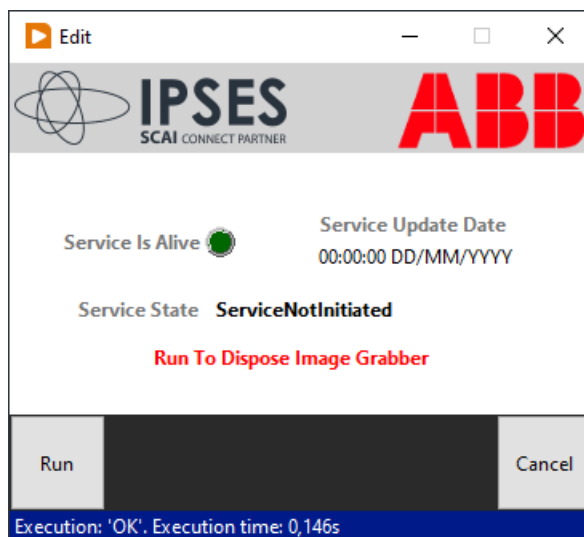
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4.2 Image Grabber Close



This Step Type has no configurable parameters in the Edit panel as it is used to close the data acquisition and processing session towards the display. However, it is possible to perform this operation by clicking on the **RUN** button during the Edit phase.



Service Is Alive indicates whether the Image Grabber service is operational (light green LED).

Service Update Date indicates the date of the last status update of the "Image Grabber" service.


Service State indicates the status of the Image Grabber service.

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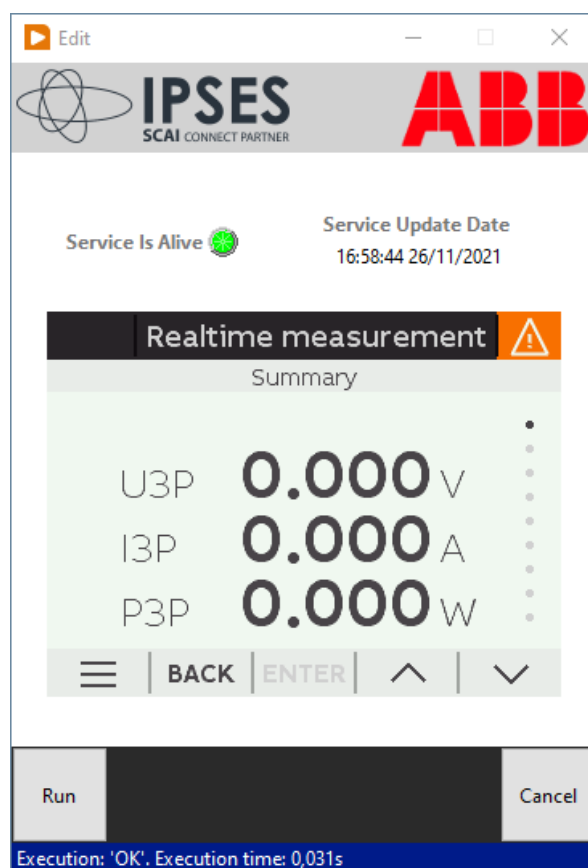
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4.3 Image Grab



This Step Type has no configurable parameters in the Edit panel as it serves to bring into memory the last image sniffed by the service. It is possible to perform this operation by clicking on the **RUN** button during the Edit phase. The last image brought in memory is reported in the dedicated box.

Service Is Alive indicates whether the Image Grabber service is operational (light green LED).


Service Update Date indicates the date of the last status update of the "Image Grabber" service.

IPSES s.r.l.

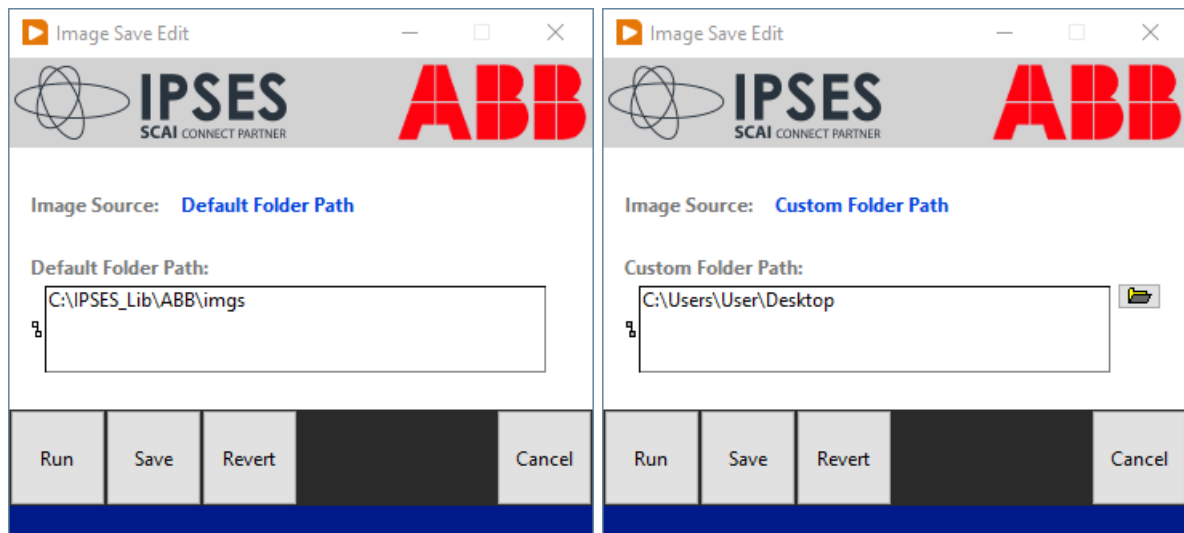
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4.4 Image Save



This Step Type allows to configure the saving of image acquired with the Image Grabber step type. You can choose between the default path (defined by a configuration file located in the packed library installation folder, i.e.:

"C:\IPSES_Lib\ABB\x86_2020\ImageTesting\Config_ImageTesting.txt") or a path selected by the operator. The image is saved in bitmap format with a file name encoding the date and time of the image (e.g.: "20211126_163240_945.bmp").

Image Source allows to define the path type where to save the images during the RUN.

Default Folder Path indicates the default path defined in the configuration file "Config_ImageTesting.txt".


Custom Folder Path allows to define a custom path where to save the images during the RUN.

IPSES s.r.l.

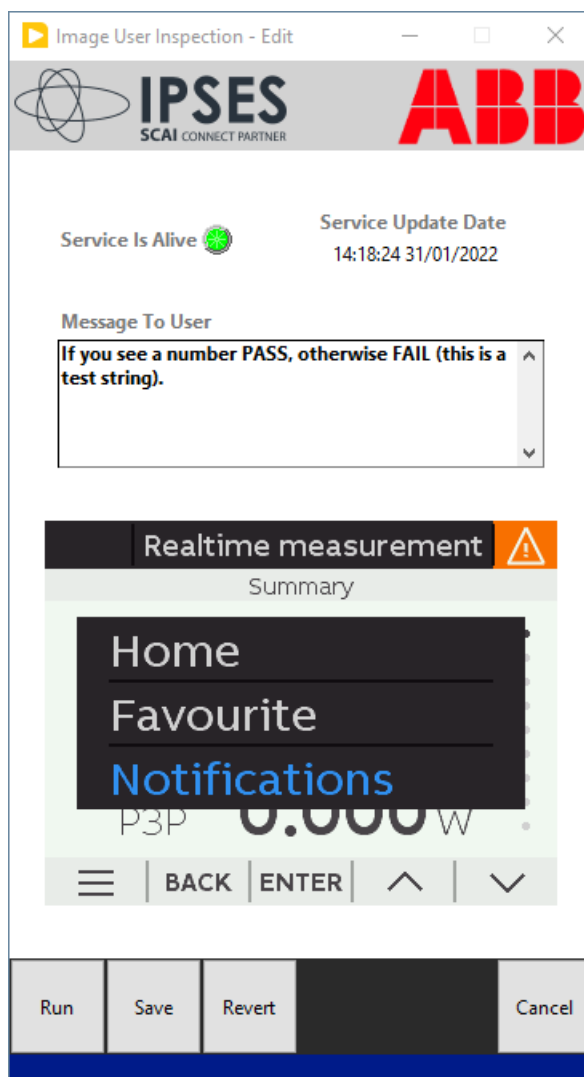
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4.5 Image User Inspection




This Step Type allows to configure a custom “**Message To User**” that will be shown during the Run execution. The Run shows a Pop Up exposing the last image fixed by 'Image Grab' and allows operator to manually indicate whether the test is PASS or FAIL. It is possible to perform this operation by clicking on the RUN button in the Edit phase. The last image fixed is shown in the dedicated box.

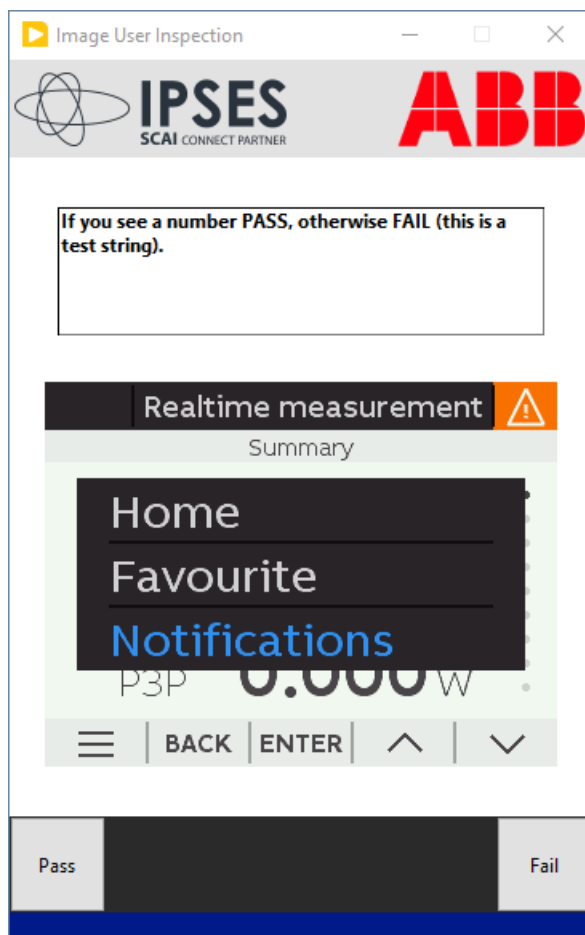
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	Code: ABB M4M Revision: Rel 02.04.000 Date: 07/03/2022	



Pass button allows the operator to set the test step as a success.


Fail button allows the operator to set the test step as a fail.

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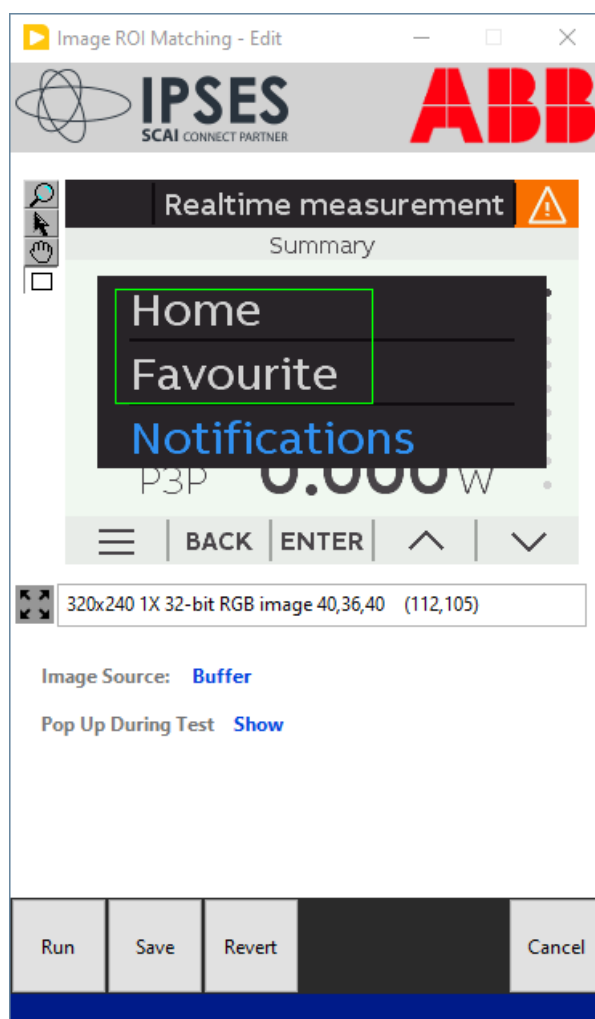
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4.6 Image ROI Matching




This Step Type allows to compare pixel by pixel a ROI of a grabbed image to a previously defined matrix of pixels. In Edit phase, "**Image Source**" sets the reference image to define the matrix of pixels: when "File" is selected, an existing image file path must be indicated; when "Buffer" is selected, the reference image is the image fixed by the step type "Image Grab". Once a valid image source is set, the image will populate the indicator and a ROI could be defined through mouse interaction. "**Pop Up During Test**" configure the behavior of the step type during execution, if "Show" is selected, a Popup will appear showing the comparison between the Image grabbed and the reference matrix of pixels, while, if "Hide" is selected, the comparison will be performed without such indication. The duration of the

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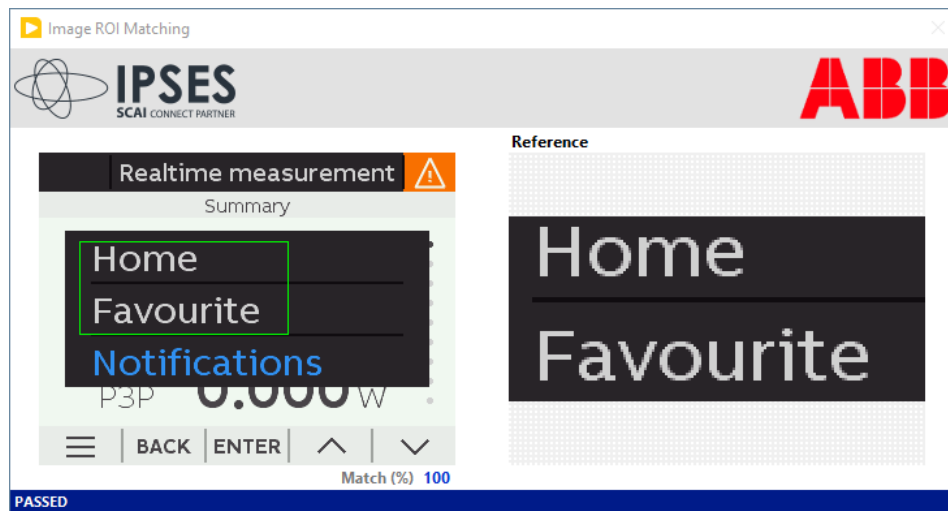
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comparison Popup is defined in the Configuration File at "C:\IPSES_Lib\ABB\x86_2020\ImageTesting\Config_ImageTesting.txt".

The test will PASS only if all the pixels of the selected ROI match the reference matrix of pixels.

The comparison Popup that could be shown during execution has the following appearance:




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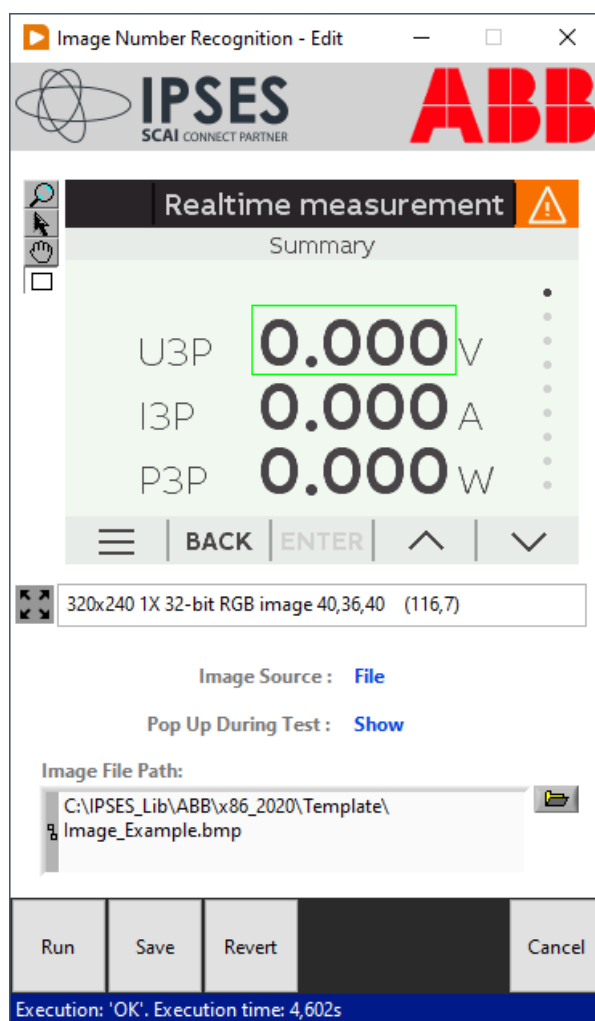
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4.7 Image Number Recognition




This Step Type allows to identify numbers present in a selected ROI. The recognition process is based on a fonts database defined in a file at same level of Packed Library (i.e.: "C:\IPSES_Lib\ABB\x86_2020\ImageTesting\FontMap.bin"). In Edit phase, "**Image Source**" sets the image on which the number recognition takes place: when "File" is selected, an existing image file path must be indicated; when "Buffer" is selected, the target image is fixed by the step type "Image Grab". Once a valid image source is set, the image will populate the indicator and a ROI could be defined through mouse interaction. "**Pop Up During Test**" configure the behavior of the step type during execution, if "Show" is selected, a Popup will appear showing the recognition process. The duration of the Popup is defined in the Configuration File at same level of Packed Library (i.e.: "C:\IPSES_Lib\ABB\x86_2020\ImageTesting\Config_ImageTesting.txt").

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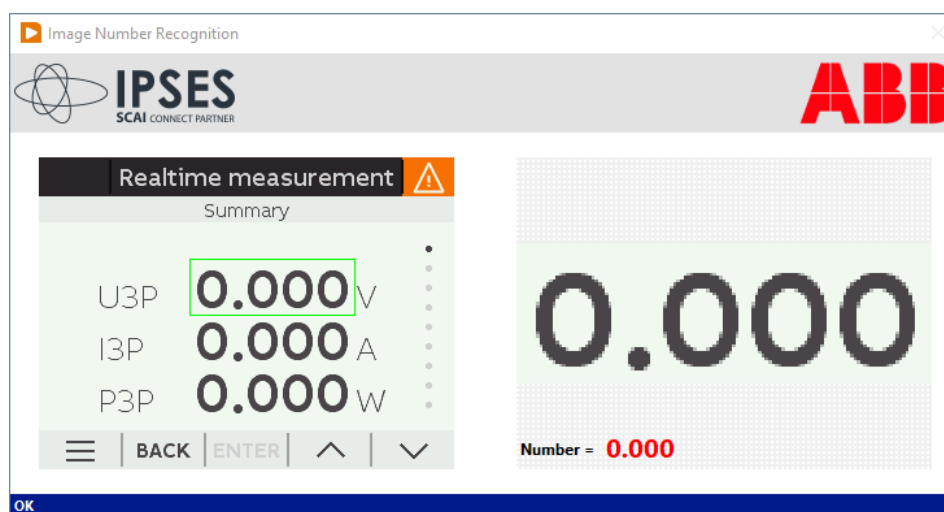
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The test will PASS only if a number is recognized and stored in "Result.NumberDetected" of the step type.

The comparison Popup that could be shown during execution has the following appearance:




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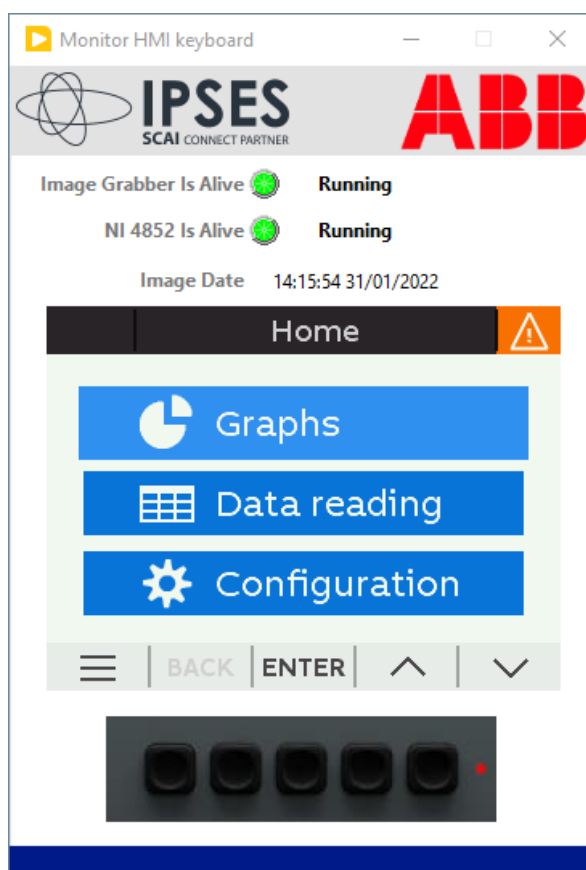
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4.8 Image Monitor Init



This Step Type has no Edit phase. During execution it shows a Monitor Panel giving information about “Image Grabber” and “Simulation Typing” services. Green LEDs indicate that services are correctly running. The picture shows in real time last complete image sniffed (Image Date is the related date). Red dots appearing on the M4M keyboard indicate in real time which kind of typing simulation is executed by the “Typing Simulation” service. This panel allows the operator to have general view of the executions on the system.

4.9 Image Monitor Close


This Step Type has no Edit phase and its execution disposes the Monitor Panel.

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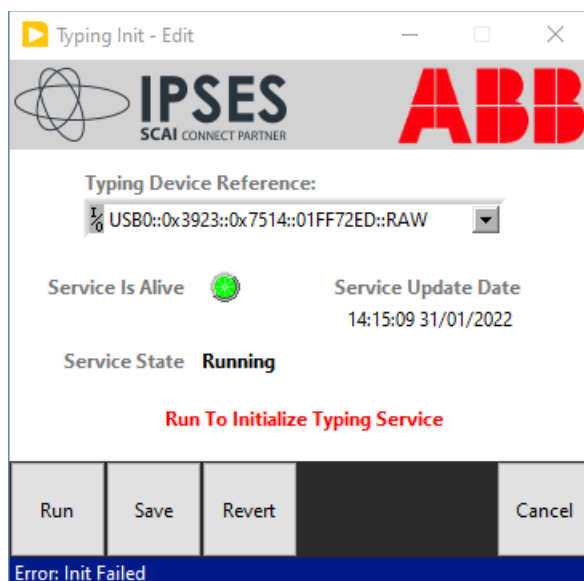
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5 CUSTOM STEP TYPES HMI M4M (SimulTyping)

In this chapter the step types for simulating key typing on the physical keyboard of M4M are briefly described, using NI-TestStand. The operating principle of the **RUN**, **SAVE**, **CANCEL** and **REVERT** controls in the Edit panels is the same as the custom step types presented previously.

The simulation system carries software-defined digital signals to the chipset, emulating the signal generated by an operator when pressing a physical key.

5.1 Typing Init




This Step Type allows to define the name of the NI 8452 device used to generate the digital signals that emulate the keypresses of the DUT. The field is populated by the string defined in the configuration file at the packed library installation path, i.e. "C:\IPSES_Lib\ABB\x86_2020\SimulTyping\Config_Typing.txt". The drop-down menu allows you to choose alternative devices of the system.

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Typing Device Reference definition of the USB 8452 device to be used for the generation of digital signals that simulate the typing of physical keys.

Service Is Alive indicates whether the "Typing Simulation" service is operational (light green LED).

Service Update Date indicates the date of the last service status update.


Service State indicates the state of the service.

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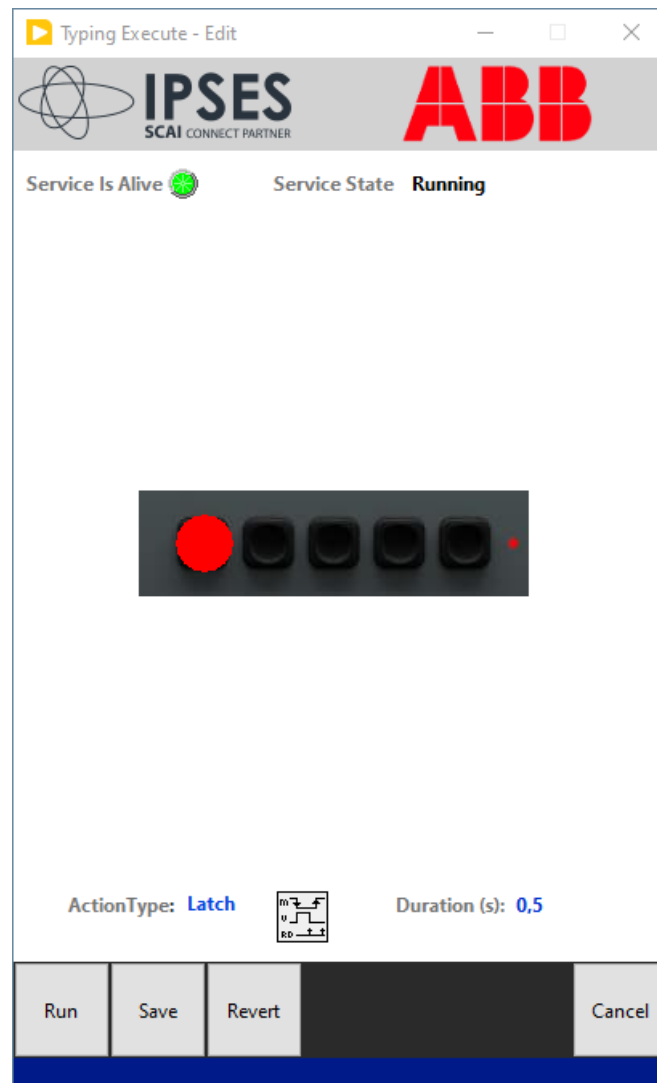
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5.2 Typing Execute



This Step Type allows to choose which key typing will be simulated at the RUN and the type of interaction ("Latch" with "Duration (s)" or "Switch" in which an uninterrupted button press is simulated until a different RUN is executed). The red circle visible on key of the physical keyboard, highlights on which key/s the simulated typing will take place

Action Type control for defining the type of interaction ("Latch" or "Switch") with the selected keys


Duration (s) control for defining the time in seconds of the "Latch" interaction if selected

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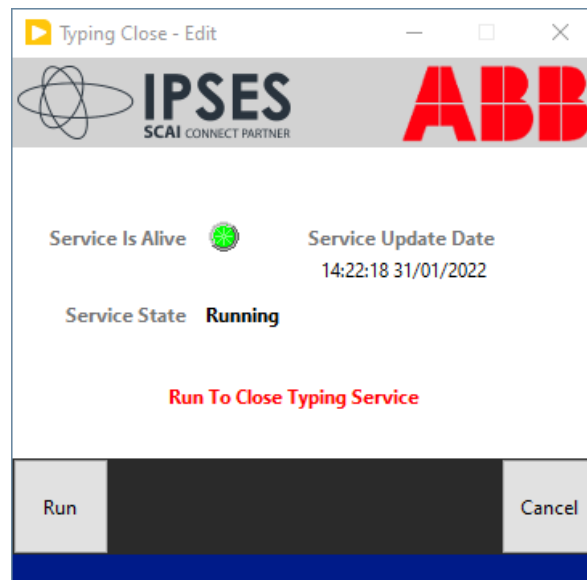
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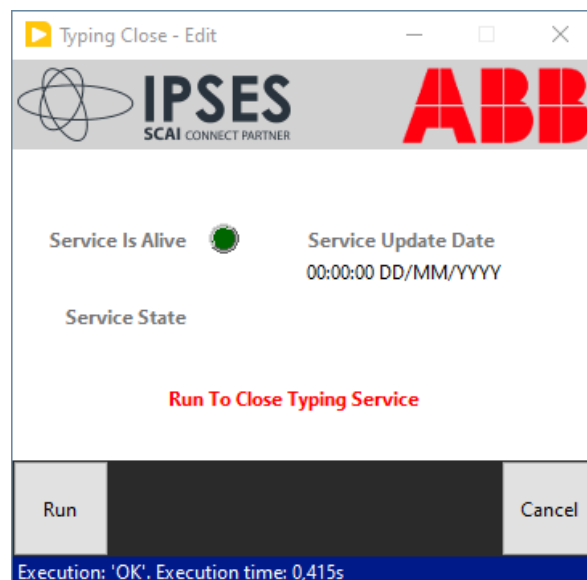
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5.3 Typing Close



This Step Type has no parameters in the Edit panel. It is used to dispose the "Typing Simulation" service. This action can be done during execution or by clicking on the RUN button during the Edit phase.




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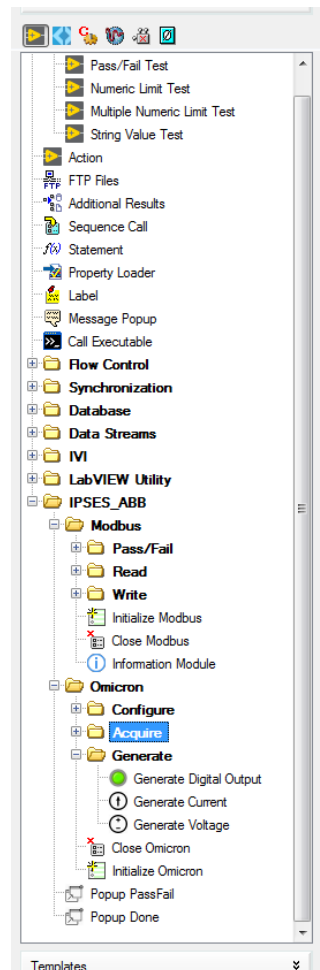
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6 USE OF STEP TYPES IN TESTSTAND

6.1 Custom Step Types Introduction

The Step Types described above are usable in the TestStand development environment once imported through the configuration files (installation). They can be inserted in the sequence by drag and drop (just like the default TestStand steps) and they are placed in Insertion Palette under the respective folder: i.e.: in the image below is showing the folder containing the step types “Modbus” and “Omicron” related to M4M




The Step Types described here, compared to the standard TestStand steps, already have the code module integrated so there is no need to go to the "Module" section to configure the LabView VI.

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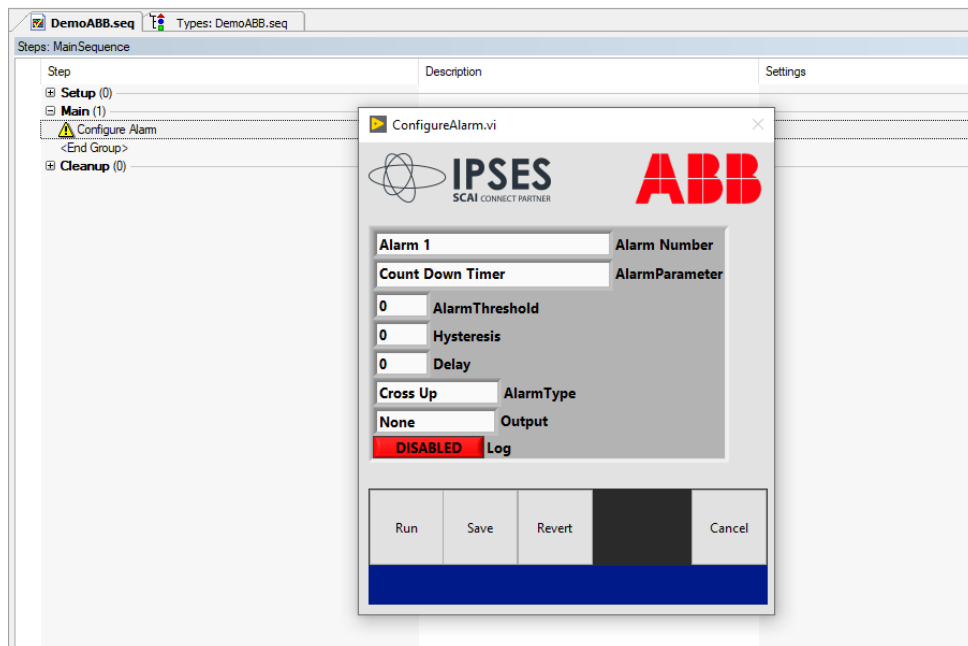
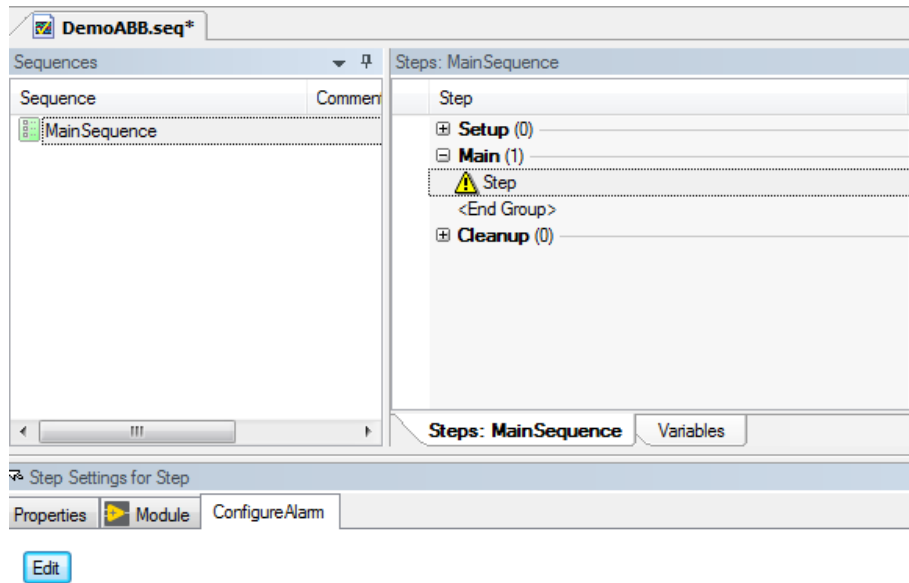
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These Step Types also have an additional feature: the presence of the "Edit" panel. Such panel aiming to configure the execution of the step, is accessible by clicking on the Edit button (see figure).




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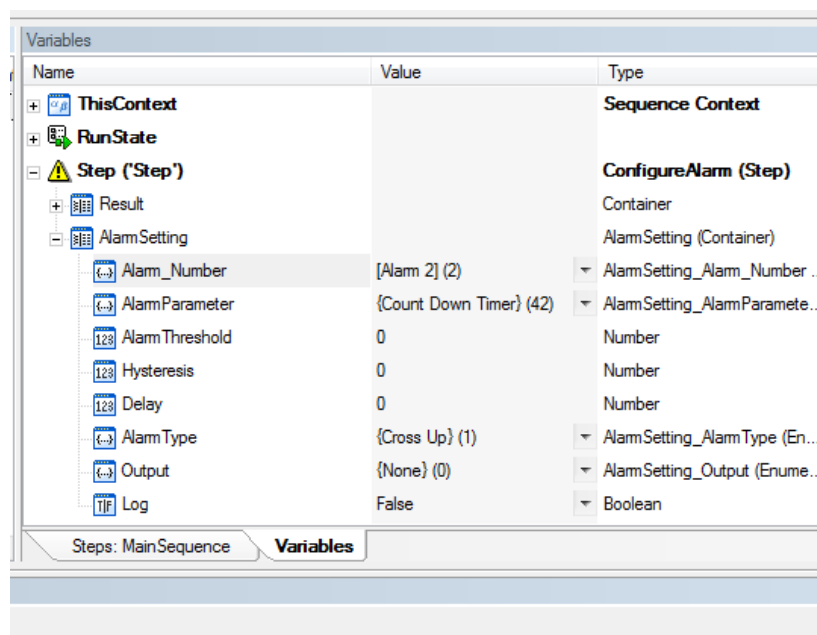
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In the Edit panel it is possible to configure the inputs of the code module that will be executed with the **RUN** command or during sequence running.

The Step Types also have different properties depending on the type of data they manage. For example, in the following image, you can see that for the step Configure Alarm, in addition to the default property "Result", there is the property "Alarm Setting": a container of N elements that are the values configurable from the Edit panel.



When parameters are configured and saved in the Edit panel, the property's default values are changed, in so doing new values are preserved even after the sequence is closed.

Moreover, being TestStand properties, they can be used to assign their value to a variable or to another property (e.g. a Sequence Parameter) of the TestStand environment.

6.2 Use Case Example: Configure Tariff Source

This section describes how to use Step Types to develop one of the test cases described in the "PMD Test Cases" document: PMD 1112.


The Test consists of configuration and check on HMI of each of the three Tariff Sources (Clock, Input, Communication). Therefore, Step Types **Configure Tariff Source** and **HMI Check Required** will be used.

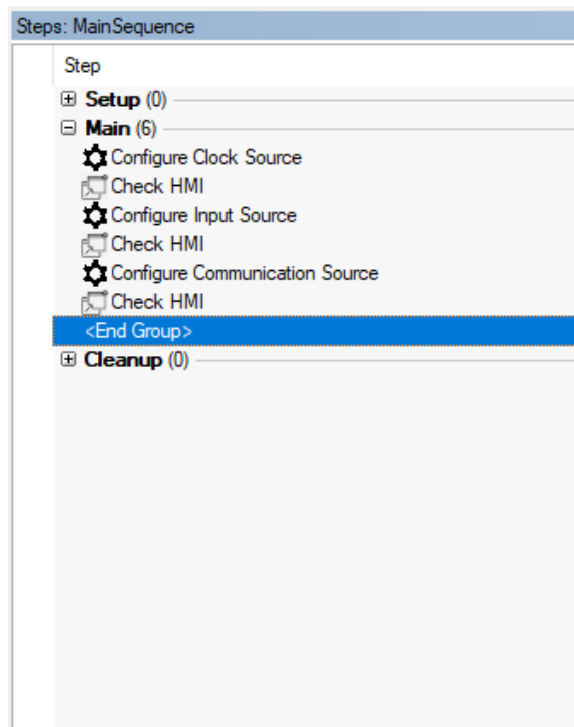
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Registered office : Piazzale Giulio Cesare, 9 - 20145 Milan ITALY

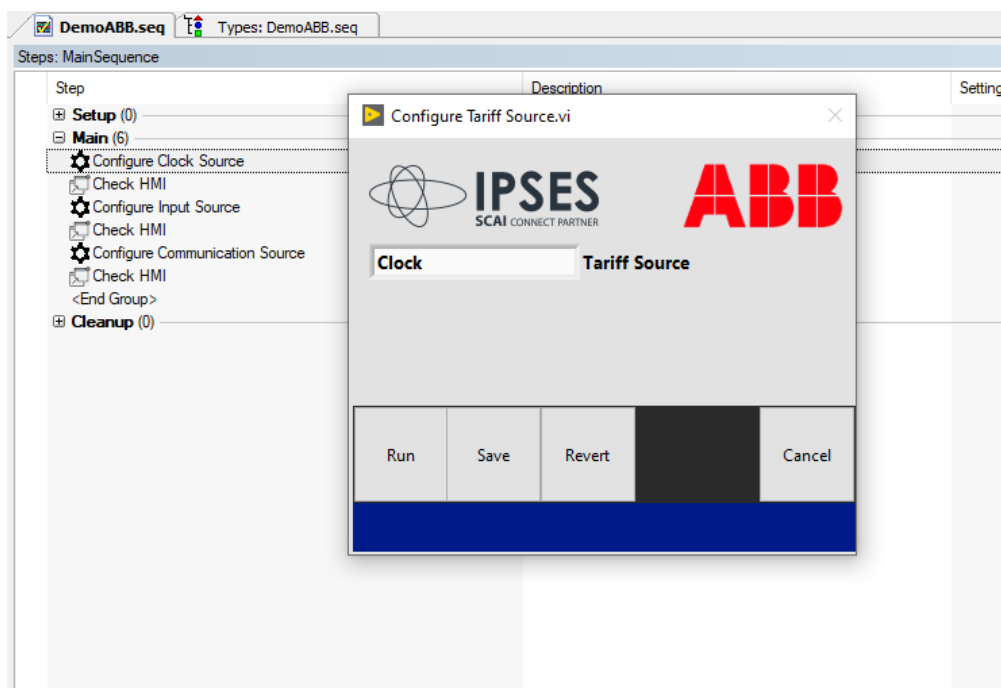
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As shown in the image above, 3 pairs of the two Step Types are added in sequence and configured. The configuration of the Tariff Source "Clock" case is shown below.




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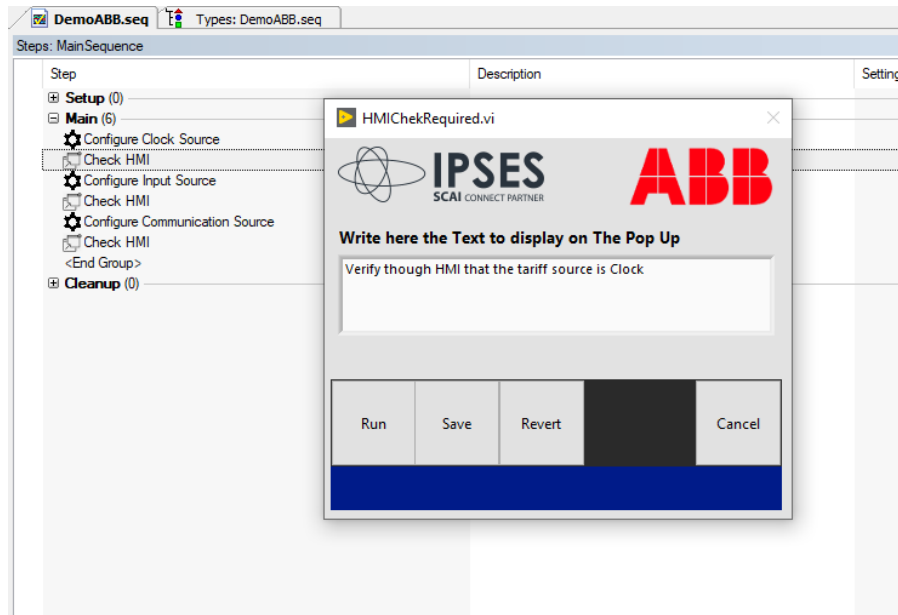
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The image above shows how to configure the "Clock" as Tariff Source. You must then click **SAVE** button to keep the configuration also at runtime.



The image above shows how to configure the Pop up with the phrase "Verify though HMI that the tariff source is Clock" in order to suggest what to check on the HMI when running the test.

The same procedure should be done for the "Input" and "Communication" cases.


What we will see during the test execution is shown in the image on the following page.

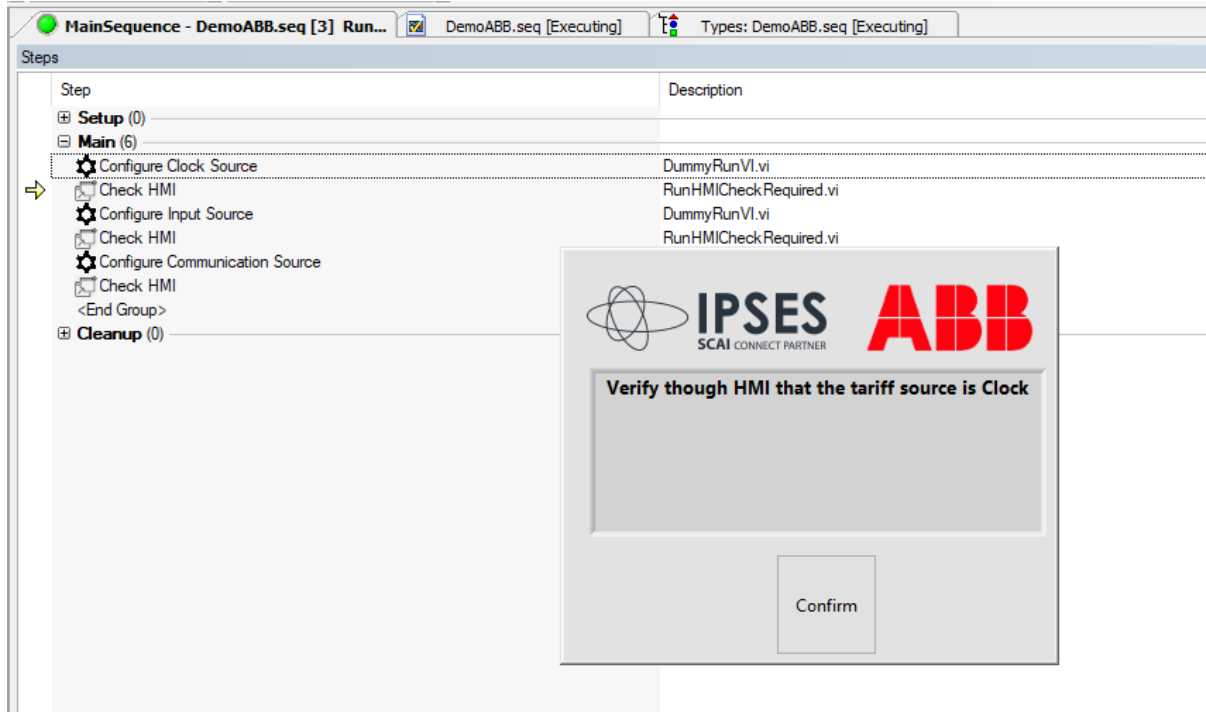
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6.3 Use Case Example: Set Tariff Type Through Communication

Let's consider another use case always present in the document "PMD Test Cases": the PMD-1120. The Test consists in configuring the Tariff according to the combination of Input received from the DUT, to generate such signals OMICRON is used, in particular the **Generate Digital Output** step.

If, for example, Tariff "T2" has to be configured, as indicated in the document "PMD Test Cases", the combination of the first 3 inputs to be applied to the DUT is as follows:

Input 1: OFF
Input 2: ON
Input 3: ON


The first 3 inputs must be configured as "Tariff Input" through **Configure Slot** step type; this because signals to be received are digital combinations.

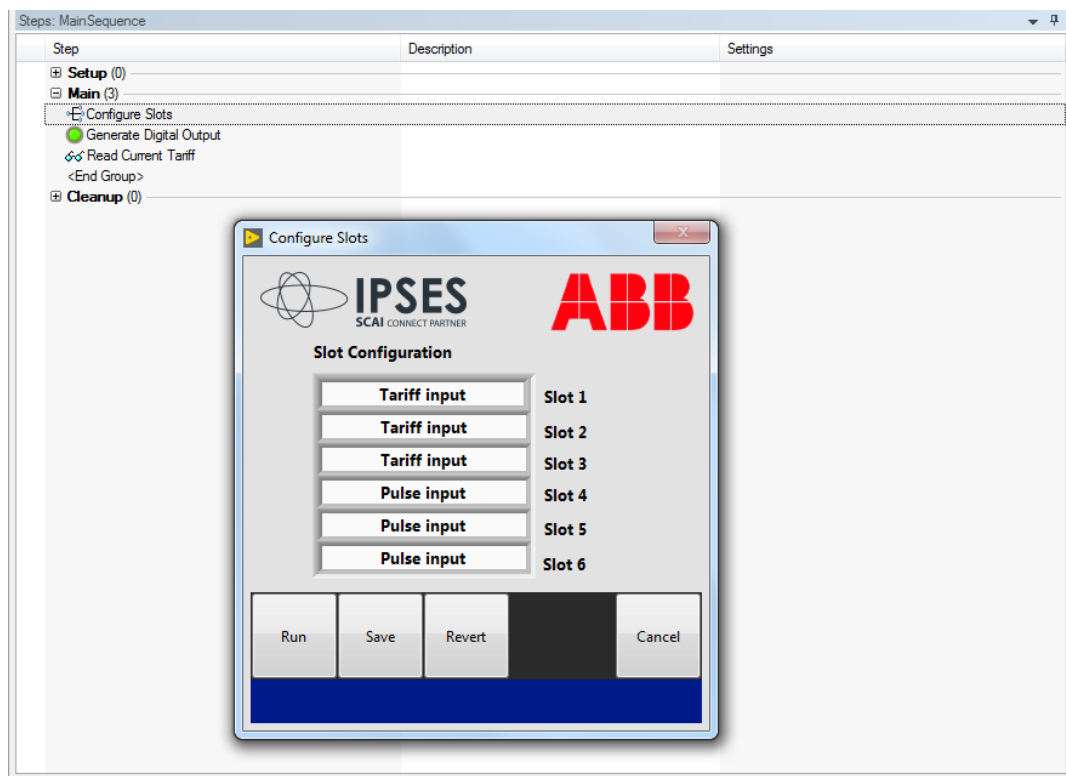
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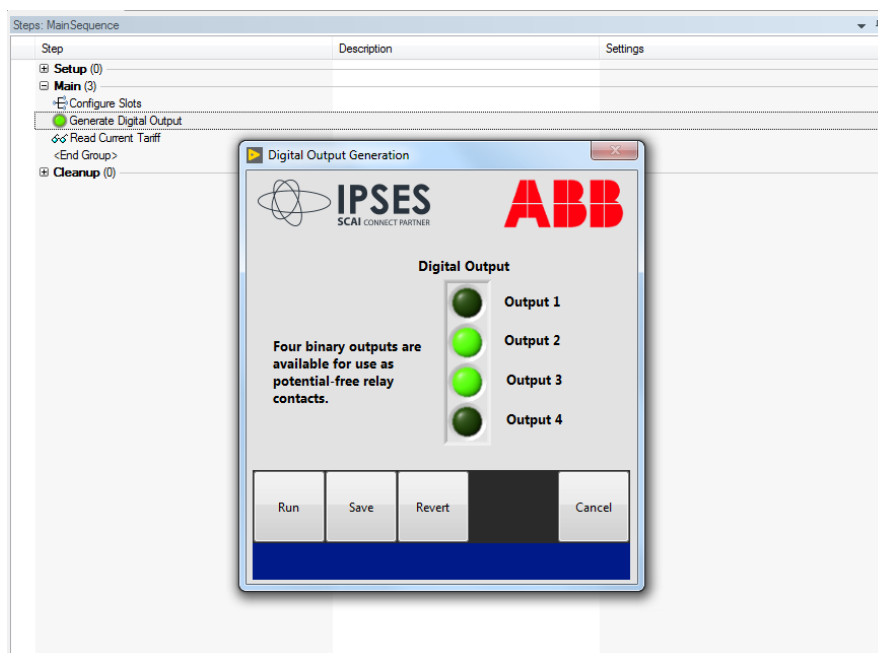
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The second Step Type to use is OMICRON's **Generate Digital Output**. The step type has to be configured with the combination listed below to select Tariff T2.




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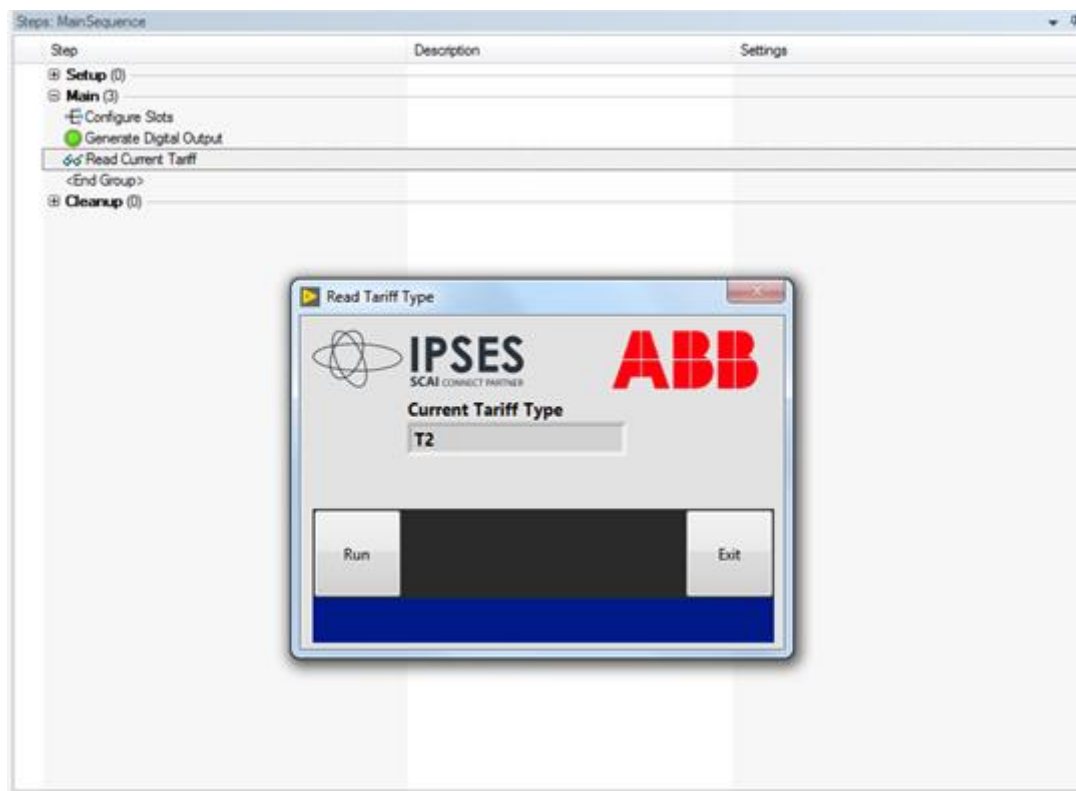
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To verify that the Tariff set is correct, the step type **Read Current Tariff** is used to read the Tariff.



In this case the Tariff is read in the Edit panel with the **RUN** command, this implies that the first two steps were performed using the **RUN** button.


During execution of the sequence, the value read from this step ("T2" in the example shown) will populate a TestStand variable, which will be used both to log the result in the report and as comparison parameter in a **pass/failed** test.

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7 SYSTEMS REQUIREMENTS

The following system requirements are recommended. Failure to comply with these requirements may result in improper step types behaviour.

7.1 Software Requirements

	LabView 2020 32bit	LabView 2020 64bit
Run-time Labview	2020 SP1	2020 SP1
TestStand	2020	2020
VISA	NI – VISA version 18.5 o higher	
Vision	Vision Development Module Runtime	
NI-845x	NI – 845x version 20.0 or higher	

7.1.1 Requirements for LabVIEW Run-Time Engine

Processor	Pentium 4M/Celeron 866 MHz (or equivalent) or later (32-bit) Pentium 4 G1 (or equivalent) or later (64-bit)
RAM	256 MB
Video card resolution	1024 x 768 pixels
Operating System	Windows 10/8.1/8/7 SP1 (32- and 64-bit) Windows Server 2012 R2 (64-bit) Windows Server 2008 R2 SP1 (64-bit)
Disk Space	620 MB

7.2 Hardware Requirements

Regarding all the step-type of display sniffing (contained in the chapter "4 CUSTOM STEP TYPES HMI M4M"), the display taken into account is the mod. TST035QVLS-24B 320x240pixel, with 65k color depth and SPI interface.

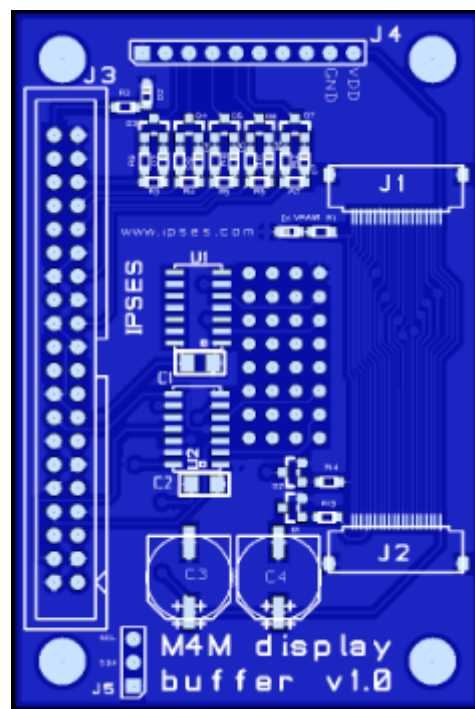
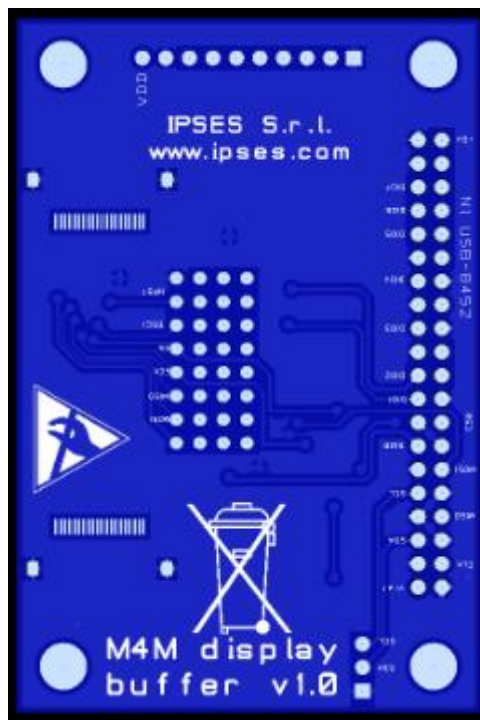
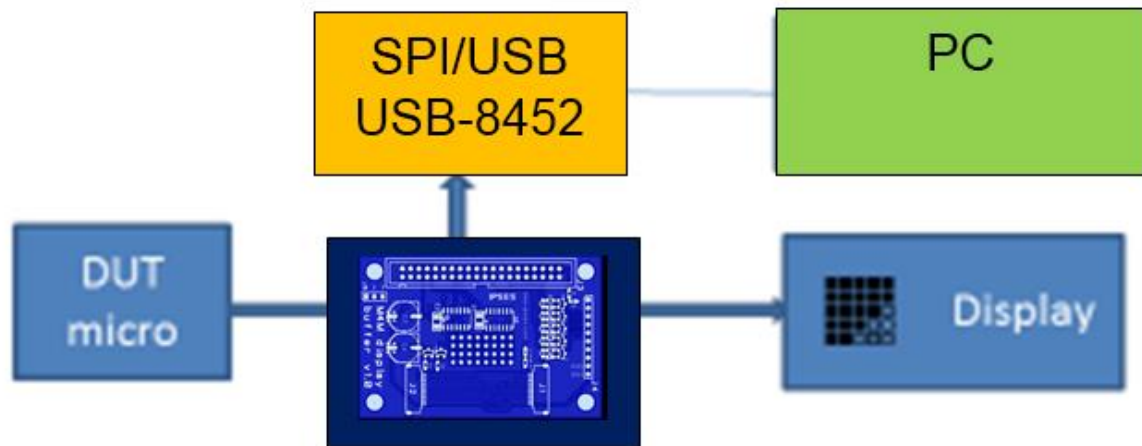
The display shall be interfaced to an I²C/SPI interface device mod. USB-8452 (NI P/N: 781964-03) by means of our appropriate buffer board, as per the synoptic shown in the next page.


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	Customer:	ABB S.p.A.	77/79
	Document	CUSTOM STEP TYPES DESCRIPTION FOR ABB M4M	
	Code: Revision: Date:	ABB M4M Rel 02.04.000 07/03/2022	

TECHNICAL SUPPORT INFORMATION

Our technicians can be contacted at the following:

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 Email : support@ipses.com

PROBLEM REPORT


The form at following page allows to collect the necessary data for correct research of a problem eventually highlighted.

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9 ENGINEERING PROBLEM REPORT

Problem describer

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Company			
Date	Tel.	Fax	

Product

Name	Version	Serial No.
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Report Type (bug, change request or technical problem)

Major bug <input type="checkbox"/>	Urgency:
Minor bug <input type="checkbox"/>	High <input type="checkbox"/>
Change request <input type="checkbox"/>	Medium <input type="checkbox"/>
Technical problem <input type="checkbox"/>	Low <input type="checkbox"/>

Problem Description

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Reproduction of Problem

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IPSES s.r.l. Action notes


Received by	Date	Report No.	Action
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