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The EUROMAP 15 Interface of Netstal Injection Moulding Machines with DSP/4 and DSP/5 Controls

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1.0	14-OCT-2008	first issue (derived from the document A0000693, which is valid for DSP/2 and DSP/3 controls)	14-OCT-2008
1.1	06-JUN-2009	Remark in Chapter 2.2 added	06-JUN-2009
1.2	04-NOV-2010	W. Meier: Chapter 9 and 10 added Corrected field layout and sample of machine identification telegram (chapter 4.1) Added field layout table for most telegrams.	04-NOV-2010
1.3	30-NOV-2010	W. Meier: Added some remarks to parameter change log transfer (chapter 9.3), data set transfer (chapter 4.13) and variable transfer (chapter 5.1)	30-NOV-2010

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1. Introduction

The EUROMAP 15 interface of Netstal injection moulding machines with DSP/2 or DSP/3 control is developed according to the **EUROMAP 15 Netstal Extension** specified in the document A0000666. This extension allows **Ethernet** to be used as the physical transport medium instead of **Bitbus**, which was the standard when EUROMAP 15 was created. The telegram structure remains the same for both media. The protocol used for communication on the Ethernet is TCP/IP.

The DSP/4 and DSP/5 controls use Ethernet with TCP/IP as the only physical transport medium (as do DSP/2 and DSP/3).

For detailed information read the document A0000666 *EUROMAP 15, Netstal Extension: Ethernet as an Alternative to the Bitbus.*

EUROMAP 15 is the standard for a protocol for communication between injection moulding machines and a central computer developed by the European Committee of Machinery Manufacturers for the Plastics and Rubber Industries and published first in 1989. Netstal had participated significantly in defining the EUROMAP 15 specifications. Since then the EUROMAP 15 interface on the Netstal machines has proved itself as reliable and fast in numerous installations.

The EUROMAP 15 interface may be included as an option when ordering new machines or bought as a retrofit kit for existing machines.

The functionality of the standard interface corresponds to the complete EUROMAP 15 specification parts 1 to 3 (exception: 3 restrictions due to safety regulations or machine control properties, see chapter 7)

EUROMAP 15 part 4, variable transfer and part 5, statistical process control (SPC) may be bought optionally as extensions to the standard interface.

In addition to the standard EUROMAP 15 features the quality relevant data of the screen pages 10/01 (Process Statistics) and 10/03 (Quality Document) may be transferred to the central computer by means of a Netstal specific extension to EUROMAP 15 if it is configured to accept them.

All Netstal moulding machines equipped with DSP/4 or DSP/5 controls and EUROMAP 15 interface may be connected to any central computer that conforms to EUROMAP 15 and handles the Netstal Ethernet extension.

If the central computer is capable of handling both Bitbus and Ethernet TCP/IP protocols (or if a Bitbus-to-Ethernet converter is used), virtually every generation of Netstal machines with DSP/5, DSP/4, DSP/3 and DSP/2 controls back to older machines with the DSP control, HP-Graphtrack machines as well as N-series machines with retrofitted EUROMAP 15 interface can be monitored by the same central computer.

The functionality of the EUROMAP 15 interface of DSP/4 and DSP/5 is nearly identical to that of DSP/2 and DSP/3.

2. Electrical Connection of the Injection Moulding Machines

2.1. Connector on Machine

There is one standalone RJ-45 socket in the control cabinet for the connection to a network or to an external computer. Its location in the cabinet depends on the machine series.

Never connect a cable to an empty socket of the Ethernet switch, which is also present in the cabinet. This switch is used solely for the internal communication. No EUROMAP 15 communication will be possible via this switch.

2.2. Connection to a network

The socket in the control cabinet of the Netstal machine is wired the same as a PC Ethernet card, i.e. it can be connected to any standard Ethernet switch or hub with standard cables (wired 1:1).

Remark:
The gateway address set in the control may get lost if the connection of the machine to the customer's network gets interrupted (cable unplugged, network switch goes down etc.).

In cases where the gateway address is required (e.g. if the machine is on another network than the central computer) there will be no communication even after the network connection will be re-established.

In installations where the machines and the central computer are in the same network this problem will not occur.

There are two workarounds:

1. Set the machine to dynamic addressing and then back to the required static address. This will reinstate the gateway address.

2. Install a small 5-port Ethernet switch in the control cabinet and connect it permanently to the machine's RJ-45 socket with a short patch cable. This will feign to the machine that the network adapter is always connected to a network, and thus the gateway address will not get lost.

2.3. Connection to another computer

Due to frequent autonegotiation problems between two different Ethernet controllers the connection between the machine and an external computer must be accomplished using an intermediate switch or hub in order to function reliably. Netstal strongly advises against the direct connection using a crossover cable.

2.4. Ethernet Cable

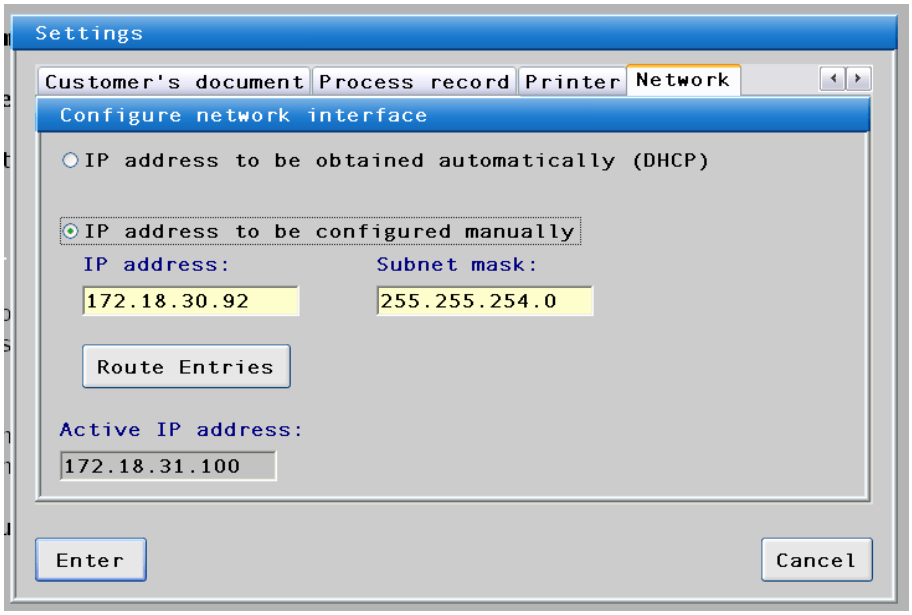
Use high quality twisted pair shielded Cat 5 STP cable with shielded RJ-45 connectors from a renowned manufacturer.

2.5. Setting the Network Settings of the Machine

Before the central computer can communicate with Netstal injection moulding machines, each must be given a unique IP address. An IP address assigned by a DHCP server does not make sense normally, since the central computer must know the address of the machines to be polled. So in most cases you might want to set a static address.

The IP address can be set with the **function menu** of the machine‘s operator terminal:
(See picture on next page)

Select **Function - Settings - Network**
You will see the a window similar to the one shown with two entry fields: the IP-address and the subnet mask.
Select “IP address to be configured manually”, enter the two values and click the „Enter“ button. The new settings will be valid immediately.



3. EUROMAP 15, Implementation in the Netstal DSP/4 and DSP/5 Controls

The EUROMAP 15 interface of the Netstal DSP/4 and DSP/5 controls is based on the EUROMAP 15 specification, version 1.2 of May 1990, document release May 1993. This documentation can be downloaded from www.euromap.org).

Part 1 (Basic Communication), part 2 (Production Monitoring and Control) and part 3 (Data Set Transfer) make up the standard implemented.

Part 4 (Production Variables Transfer) and part 5 (Statistical Process Control SPC) are interface extensions which can be purchased as an option if needed.

Part 6 (Gateway to EUROMAP 17) and part 7 (Time Stamping) are not implemented (no demand at this time).

Special feature

Unlike the standard Bitbus Interface defined in EUROMAP 15 (which is a single master system) the Netstal EUROMAP 15 implementation based on Ethernet can deal with multiple central computers simultaneously.

I.e. one computer can perform production monitoring collecting counters, machine status, alarms etc. while a second computer can do quality control simultaneously. Every computer sees only the EUROMAP 15 answers of the telegrams destined to itself.

It is obvious that downloading data sets to the machine by two computers at the same time is not possible. During a data set download by one computer a download attempt by a second computer will be denied until completion of the current transfer.

4. EUROMAP 15, Parts 1 to 3

4.1. Telegrams 001/101 Machine Identification

Telegram 001 : Request for Machine Identification

This telegram contains no additional data bytes.

Telegram 101 : Machine Identification

Byte	Contents	Description
05 .. 06	N02	EUROMAP communication protocol version
	13	Current version is 1.3
07 .. 09	N03	Machine manufacturer code
	011	Netstal
10 .. 23	A14	Commission number
24	A1	Empty field (20 Hex = Blank)
25 .. 44	A20	Machine Type and Size

Example : (CC = central computer, IMM = injection moulding machine)

CC:	01	001

IMM:	01	101	13	011	____2009018101	_	_____ELION-1750-530

For better legibility underscores are used instead of blank characters.

The identification may vary from machine to machine depending on its type and size.

According to the EUROMAP convention the field contents are right adjusted and the unused places are filled with blanks (20 Hex).

After power up the control answers with a 100 001 to the first 000 telegram (standard question) of the central computer (EUROMAP requirement).

4.2. Telegrams 002/102 Load Job Definition

Telegram 002 : Load Job Definition

Byte	Contents	Description
05 .. 16	A12	Job number (C312)
17 .. 28	A12	Part number (C313)
29 .. 40	A12	Dataset number (C315)

Telegram 102 : Response to Load Job Definition

Byte	Contents	Description
05	N1	Load job definition acknowledgement
	0	negative
	1	positive

The machine accepts the job definition only in an idle (non-production) condition in the operating modes "Manual", "Semi-Automatic" and "Automatic" and if C330 = 1 (production with job). In all other cases the job definition is refused with a negative acknowledgement.

The job number and the part (article) number (both 12 characters alphanumeric) are copied into the parameters C312 and C313 on page 09/01 (Production Control). The data set number (12 character alphanumeric) is copied into parameter C315 on page 16/06 (Service Page 4 (PAC)).

4.3. Telegrams 003/103 Request for Job Definition

Telegram 003 : Request for Job Definition

This telegram contains no additional data bytes.

Telegram 103 : Response to Request for Job Definition

Byte	Contents	Description
05 .. 16	A12	Job number (C312)
17 .. 28	A12	Part number (C313)
29 .. 40	A12	Dataset number (C315)

The machine sends the parameters listed above back to the central computer regardless of the operating mode or C330.

4.4. Telegrams 004/104 Load Production Target

Telegram 004 : Load Production Target

Byte	Contents	Description
05 .. 16	N12	Number of lots (pallets)
17 .. 28	N12	Parts in lot (pallet size, lot size)

Telegram 104 : Response to Load Production Target

Byte	Contents	Description
05	N1	Load production target acknowledgement
	0	negative
	1	positive

Note: The term "lot" stems from EUROMAP and corresponds closely to the term "pallet" as understood by Netstal (which is the receptacle that takes up the moulded parts). A production with lots requested by the central computer does not make sense unless the automatic container change is running simultaneously.

- The machine accepts the production target (order volume) through the telegram 004 in the form **m lots of n parts** in all operating modes if the following is true:

  - production with automatic pallet changer (C310 = 2)
  - C330 = 1 (production with job) and monitoring active

  Note: When a central computer wants to change the lot/container size while a machine is producing, it is allowed, however senseless. The machine will accept the change nonetheless, but the quality report is concluded and the job continues with the new values for production target and lot size. The central computer operator is responsible for the proper use of the pallet change function of the machine.

- The machine accepts the production target by means of the telegram 004 in the form **one lot of n parts** in all operating modes if the following is true:

  - production with or without manual pallet changer (C310 = 0 or 1)
  - C330 = 1 (production with job)
  - in all operating modes, even if the machine is running

- In all other cases the machine refuses the production target by sending a negative acknowledgement.

- The lot size according to EUROMAP is copied into the parameter C306 (pallet size). The number of lots according to EUROMAP is not stored.

- For technical reasons the two values of the telegram 004 as well as the product of the two values (= production target) must be smaller than 10^9.

4.5. Telegrams 005/105 Request for Production Target

Telegram 005 : Request for Production Target

This telegram contains no additional data bytes.

Telegram 105 : Response to Request for Production Target

Byte	Contents	Description
05 .. 16	N12	Number of lots (pallets)
17 .. 28	N12	Parts in lot (pallet size, lot size)

- During production with automatic pallet changer (C310 = 2), the machine returns the number of pallets (lots) and the value of C306 (pallet size, lot size) regardless of the operating mode, C330 and job status to the central computer.

- When producing without or with manual pallet changer (C310 = 0 or 1), the machine returns 1 as the number of pallets (lots) and the production target C302 as the pallet size (lot size) regardless of the operating mode, C330 and job status.

4.6. Telegrams 006/106 Request for Job Status

Telegram 006 : Request for Job Status

This telegram contains no additional data bytes.

Telegram 106 : Response to Request for Job Status

Byte	Contents	Description
05 .. 16	N12	Number of finished lots (pallets)
17 .. 28	N12	Parts in running lot (pallet)
29 .. 34	N6	Reject parts since start of job (C1003)
35 .. 40	N6	Average cycle time in hundredth of a second (T412)
41 .. 43	N3	Actual number of cavities (C303)

Depending on the automatic pallet changer parameter value the machine sends different parameters for “Number of finished lots” and “Parts in running lot” :

- When producing with automatic pallet changer (C310 = 2) the machine answers :

  C317 - 1 Number of finished lots (pallets)
  C316 Parts in running lot (pallet)

regardless of the operating mode and C330.

- When producing without or with manual pallet changer (C310 = 0 or 1) the machine answers :

  0 no finished lots (pallets)
  C324 Parts in running lot (pallet)

regardless of the operating mode and C330.

4.7. Telegrams 007/107 Load Production Control

Telegram 007 : Load Production Control

Byte	Contents	Description
05	N1	Load production command
	0	Remote Stop of Production The machine stops at the end of the current cycle. The internal list # 10 is executed.
	1	Remote Start of Production Due to safety regulations this command is **not implemented** ! The machine answers with negative acknowledgement.
	2	Remote Start Up The list # 1 (start) is executed.
	3	Remote Shut Down The list # 2 (reduced operations) is executed.

Telegram 107 : Response to Load Production Control

Byte	Contents	Description
05	N1	Load production acknowledgement
	0	negative
	1	positive

4.8. Telegrams 008/108 Request for Production Status

The machine answers the central computer, depending on the event, the following status: (Sequence: standard question 000, standard answer 100 008, standard question 008, answer 108 x yy)

Telegram 008 : Request for Production Status

This telegram contains no additional data bytes.

Telegram 108 : Response to Request for Production Status

Byte	Contents	Description
05	N1	Production Status
	0	Production
	1	Production Preparation
	2	Production Target reached
	3	Production Interrupted
	4	Waiting for Job
	5	Waiting for Production

06 .. 07	N2	Reason for production Status
	bb	New EUROMAP 15 implementations must fill the bytes 6 and 7 of the telegrams 108 0, 108 2, 108 4 and 108 5 with blanks (20 Hex), so that all telegrams 108 have the same length.
	xx	Reason for production interruption C358 (00 to 21 defined by EUROMAP, 22 to 49 reserved for EUROMAP, 50 to 99 free for machine manufactures). This reason is determined by the machine and cannot be entered by hand.
	yy	Reason for production preparation C357. With this parameter the operator can inform the central computer why a machine is idle, what work is being performed on the machine (maintenance, setting up, mould change, etc.)

On a running machine, the entering of C357 does not cause the telegram 108 1 yy to be sent, because the status of a running machine must be 108 0 bb.
The following list shows the various production status sent at different standard production situations.

- Machine running: 108 0 bb Production
- Operator enters the parameter C357 (reason for production preparation) on page 09/01 (Production Control) on an idle machine: 108 1 yy Production Preparation
- Machine has reached the production target: 108 2 bb Production Target reached
- Machine has been switched on: 108 3 00 Production Interrupted
- Machine receives a job definition from the central computer: 108 3 00 Production Interrupted
- Machine stopped due to an error or stopped by operator: 108 3 xx Production Interrupted
- Operator calls up a production job from the function menu "data manipulation, central computer": 108 4 bb Waiting for Job
- Machine receives a new production target from the central computer or from the operator (entry on page 09/01): 108 5 bb Waiting for Production Start

4.9. Telegrams 009/109 Request for Machine Status

Telegram 009 : Request for Machine Status

This telegram contains no additional data bytes.

Telegram 109 : Response to Request for Machine Status

Byte	Contents	Description
05	N1	Machine Status
	1	Set-up mode
	2	Manual mode
	3	Semiautomatic mode
	4	Automatic mode

The machine status is understood as the machine's operating mode.

4.10. Telegrams 010/110 Request for Alarms

Telegram 010 : Request for Alarms

This telegram contains no additional data bytes.

Telegram 110 : Response to Request for Alarms

Byte	Contents	Description
05 .. 08	A4	Alarm reason 1 (newest alarm)
09 .. 12	A4	Alarm reason 2
13 .. 16	A4	Alarm reason 3
17 .. 20	A4	Alarm reason 4
21 .. 24	A4	Alarm reason 5
25 .. 28	A4	Alarm reason 6
29 .. 32	A4	Alarm reason 7
33 .. 36	A4	Alarm reason 8
37 .. 40	A4	Alarm reason 9 (oldest alarm)

When an error occurs, the machine writes the alarm numbers as they appear on the CRT screen, into an internal buffer (max. 9). In case that more than 9 alarms appear, only the first 9 (oldest) are stored in the buffer, under the assumption that the first 9 alarms will provide enough information for analyzing the original cause of the interruption in production. Possible further alarms will of course be of interest to the machine operator, but not to the central computer.

The central computer can read the contents of the alarm buffer at any time with the telegrams 010/110 (if needed more than once, i.e. the alarm buffer is not cleared by reading). The alarm buffer is automatically cleared at the beginning of a new cycle. If an alarm comes up that does not stop the machine, then this alarm is not stored in the alarm buffer.

The machine sends no telegram 100 010 as a response to standard question 000. It is the duty of the central computer to read the alarm buffer when the machine is going idle.

4.11. Telegrams 011/111 Request for Operator Identification

Telegram 011 : Request for Operator Identification

This telegram contains no additional data bytes.

Telegram 111 : Response to Request for Operator Identification

Byte	Contents	Description
05 .. 16	A12	Operator Identification (C314)

The machine reports the Personnel Number C314 that appears on the page 09/01 (Production Control) to the central computer:

- With every change of this number by the machine operator (answers with 100 011 to the standard question).
- When the central computer requests it with 011.

4.12. Telegrams 012/112 Load Time and Date into Control

Telegram 012 : Load Time and Date

Byte	Contents	Description
05 .. 06	N2	Seconds (0 .. 59)
07 .. 08	N2	Minutes (0 .. 59)
09 .. 10	N2	Hours (0 .. 23)
11 .. 12	N2	Day (1 .. 31)
13	N1	Day of week (1 = Monday .. 7 = Sunday)
14 .. 15	N2	Month (1 .. 12)
16 .. 17	N2	Year (0 .. 99)

Telegram 112 : Response to Load Time and Date

Byte	Contents	Description
05	N1	Load time and date acknowledgement
	0	negative
	1	positive

The date and time in the machine control are replaced by the new values received from the central computer. This function can be used to set all machines to the exact same time.

4.13. Telegrams 020/120 to 025/125: Transfer of the Machine Setting Data from the Central Computer to the Machine and vice versa

These functions are implemented in accordance with EUROMAP 15.

The machine allows the following functions:

- Load data set from central computer into machine control, initiated by the central computer. Only possible if machine is idle.
  (Duration 20 to 40 seconds, depending on central computer performance)

- Load data set from central computer into machine control, initiated at the machine. Only possible if machine is idle and in operating mode "Hand". (Duration 20 to 40 seconds)

- Save data set from machine to central computer, initiated by the central computer. Possible if machine is idle or running, in the operating modes "Hand" or "Automatic". (Duration 20 to 40 seconds)

- Save data set from machine to central computer, initiated at the machine. Possible if machine is idle or running, in the operating modes "Hand" or "Automatic". (Duration 20 to 40 seconds)

- Query if a certain data set is available in the central computer. Possible in the operating modes "Hand" or "Automatic".

- Erase a data set in the central computer, initiated at the machine. Possible in the operating modes "Hand" or "Automatic".

If the Netstal specific extension described in chapter 10.4 is used the telegram size for data set transfer can be enlarged to max. 1024 bytes. In this case the selected telegram size has to be used for the entire data set transfer. A new size will be used only upon start of next data set transfer.

4.14. Telegrams 096/196 Communication Flow out of Sequence

Implemented, although will only appear due to a severe error in the machine control or in the central computer.

4.15. Telegrams 097/197 Incorrect Telegram Contents

Implemented, although will only appear when the central computer sends incorrect telegrams to the machine control.

4.16. Telegram 198 Telegram Type not Implemented

Sent form the machine to the central computer when the machine has received a not-implemented telegram.

4.17. Telegrams 099/199 Cancel Data Transfer

The machine can interrupt an on-going data set transfer if an error should occur in the control (e.g. illegal characters).

The machine control has additionally a timeout timer of one minute, after which the operator keyboard is freed up again in case the connection to the central computer is interrupted or the central computer crashes during a data set transfer. Such an connection interruption is shown as an alarm message on the screen.

5. EUROMAP 15, Part 4, Variable Transfer

5.1. General

The Production Variable Transfer is an optional extension of the EUROMAP 15 interface and is therefore only accessible if the option was ordered.

This feature is very useful, since it allows for reading every parameter from the control at any time, be they actual values or set values.

The Production Variable Transfer is based on EUROMAP 15, part 4, version 1.3, May 1993, document release May 1993. Production variables are understood as the required programming parameters for setting up the machine.

It is possible to transfer up to 5 production variables of varying length in a single standard size telegram. The central computer must know the designation of the variable in question (parameter name, e.g. C312) in order to come to the desired values, regardless of the machine brand.

In principle, according to EUROMAP, a transfer is possible in both directions, i.e. also from the central computer to the machine. The following danger must be emphasized: If the central computer carries out a parameter change on a running machine whose values radically change the movements of the machine, severe damage can result if no machine operator is standing by who can interact immediately.

If the Netstal specific extension described in chapter 10.4 is used the telegram size for variable transfer can be enlarged to max. 1024 bytes. In this case much more than the 5 variables mentioned above can be transferred at once. Nevertheless the standard syntax of the telegram is also used for large telegrams. Both versions of the variable transfer (standard and Netstal specific) are supporting large telegrams.

5.2. Standard Variable Transfer According to Part 4

5.2.1. Variable Upload

Upload = Transfer from the machine control to the central computer.

- All variables in the machine control that are addressable as named parameters can be accessed by the central computer, thus all parameters that can be selected on the screen (set values) as well as all displayed actual values can be transferred.

- Format of the transferred variables:
  Field length, number of places, location of the decimal point (if existing) correspond exactly to the representation of the parameter in question on the screen.

  Numbers that are smaller than the maximum value (e.g. parts counter) are packed into the maximum field length, right adjusted, with leading blanks.

  ASCII-fields (e.g. article number, personnel number) are always transferred with the full field length, even if they are only partially filled or empty (blank).

- Parameters whose data type is neither "numeric" nor "alphanumeric", i.e. composed of a number of single bits (e.g. Netstep parameters) are converted to the Hex-ASCII format prior to the transfer to the central computer and are filled into telegram 131 as a series of ASCII characters 0..9 and A..F.

Example for the transfer of some variables :
(CC = central computer, IMM = injection moulding machine)

CC:	01	031	_S031	_S032	_S033							
IMM:	01	131	_S031	5	100.0	_S032	5	_80.0	_S033	5	_50.0	

CC:	01	031	_Z012	_Z013	_Z014	_Z015						
IMM:	01	131	_Z012	3	210	_Z013	3	200	_Z014	3	__0	_Z015	3	216

CC:	01	031	_T652	_T656	_T671							
IMM:	01	131	_T652	6	111.11	_T656	6	222.22	_T671	6	333.33	

CC:	01	031	_T021	_S000	_T031							
IMM:	01	131	_T021	6	__2.12	_S000	5	_10.0	_T031	6	__1.37	

CC:	01	031	_C301	_C302	_C303							
IMM:	01	131	_C301	9	_____0	_C302	9	____50000	_C303	2	_1	

For better legibility underscores are used instead of blank characters.

5.2.2. Variable Download

Download = Transfer from the central computer to the machine

- In theory, all parameters that can be entered at the operator panel can also be written by the central computer into the machine control within the same boundaries of those that are hand-entered.

- However, there are some special parameters which are unchangeable.

- Actual values cannot be changed by the variable download.

- The download is possible on both running and idle machines.

- In case the central computer sends variables in a data format that does not correspond to the format of the variable in the machine control (e.g. too long or too short, values too large, alphanumeric instead of numeric) the machine will still attempt to form correct values from it. If this is not successful, the machine responds with "not accepted" for those variables.

  Remark:
  An "intelligent" central computer would first read the variable to be modified, analyze its format, and then send an altered value in the correct format to the machine.

5.3. Variable Transfer for Indexed Parameters (Netstal Specific)

DSP/4 and DSP/5 controls use indexed parameters, which means that there are several instances of the same parameter.

The designations of these indexed parameter are longer than those of the ordinary parameters. So they do no longer fit into the five character variable field of the EUROMAP 15 telegrams 131 and 032.

Since Netstal is not entitled to change the standard EUROMAP 15 definitions, we chose to define some official manufacturer specific extensions (which every manufacturer is allowed to do) to allow transmission of the new variable types to and from central computers.

The transfer mechanism is identical to the standard variable transfer, except that the following new telegrams have to be used:

- 731 as the equivalent to 031
- 732 as the equivalent to 032
- 831 as the equivalent to 131

Since the machine does never initiate variable transfers itself, the equivalent to telegram132 is not needed and therefore not defined.

The variable fields are 12 characters long (instead of 5). The variable names must be entered into the variable fields as displayed on the machine screen (designation letter(s), up tp five digits variable number, a decimal point, plus up to three digits for the index).
As known from the standard transfer, they must be right justified in the 12 character fields. The telegram must be filled with ASCII blanks up to the length of 45 user bytes, if only a portion of the telegram is used (as in standard).

Due to the space increase of the new designation fields, in most cases only two variables will fit into the telegrams 831 and 732 if the standard telegram size is used.

Example: (CC = central computer, IMM = injection moulding machine)

Read the parameters V51.1 and V51.2, the result is 0 for both

CC:	01	731	_____V51.1	_____V51.2				
IMM:	01	831	_____V51.1	1	0	_____V51.2	1	0

Read the parameters T51.1 and T51.2, the result is 2.25 and 2.48

CC:	01	731	_____T51.1	_____T51.2				
IMM:	01	831	_____T51.1	4	2.25	_____T51.2	4	2.48

Try to read the parameters P114.2, P115.1 and P115.2

CC:	01	731	_____P114.2	_____P115.1	_____P115.2			
IMM:	01	831	_____P114.2	4	1000	_____P115.1	3	940

Result: only 2 parameters fit into the telegram

Set the Parameters C312 to ”fish” and C314 to ”rhinoceros”

CC:	01	732	_____C312	4	fish	_____C314	:	rhinoceros
IMM:	01	134	1	1	1			

The three digits ”1” in the telegram 134 have the standard meaning (variable download OK, first parameter accepted, second parameter accepted).

For better legibility underscores are used instead of blank characters.

6. EUROMAP 15, Part 5, SPC Statistical Process Control

6.1. General

The EUROMAP 15 interface of the DSP/4 and DSP/5 controls can optionally be extended with "EUROMAP 15, part 5, process data transfer for statistical process control (SPC)". With this option, the machine is capable of providing the central computer with the raw data for the statistical process control in accordance with ISO 9000 or another form of data analysis.

The central computer directs the machine by means of configuration telegrams to collect the process data according to its specification and keep the data ready for transfer. At regular intervals, the central computer picks up this data and interprets it suitably.

In the machine control no analysis of the data is undertaken. The collected process data cannot be examined at the machine. However, on the screen page 11/02 (SPC Data Collection) the SPC configuration values from the central computer, as well as the current status of the SPC data collection are visible.

6.2. Telegrams 200/300 Set Data Collection Mode

All polling and sampling modes according to EUROMAP are available.

6.3. Telegrams 201/301 Select Parameters

The following process parameters and additional parameters may be measured:

(The numbers correspond to the numbers of the parameter list in the EUROMAP 15 document part 5 (SPC))

The first 9 real process parameters are those of the page 10/01 (Process Statistics):

- 04 injection time
- 05 metering time
- 06 cycle time
- 08 melt cushion
- 09 V-p changeover position
- 10 start of injection
- 15 max. hydraulic injection pressure
- 19 max. cavity pressure
- 22 flow index (see Netstal machine manual)
- 90/91 number of completed lots/containers
- 92/93 number of parts in current lot/container
- 94/95 cycle counter since job start
- 96 time
- 97 date

The parameter groups 0, 1 and 2 are available. The above listed parameters may be inserted into the groups 1 and 2 in any order.

6.4. Telegrams 202/302 Remote Control of Sampling Process at Machine

Telegram 202 : Remote Control Sampling Process

Byte	Contents	Description
05	N1	Sampling process control
	1	Starts the data collection after a delay of x seconds or cycles
	2	Suspends the data collection.
	3	Continues the data collection with the selected definitions. A sample interrupted by "suspend" will not be completed. After a delay of x seconds or cycles a new sample will be started.
	4	Stops the data collection and sets the parameter definitions to "undefined"
06 .. 08	N3	Sampling delay in seconds or cycles

6.5. Telegrams 203/303 Take Sample (Request from Central Computer)

When the sampling mode equals 4, the machine does not start a sample by itself. With the telegram 203 the central computer can initiate a sample on demand.

6.6. Telegrams 204/304 Request for Sampled Data

With the telegram 204 the central computer retrieves the measured values gathered by the machine. The last telegram the central computer sends must have byte 8 set equal to 1 (= last request), so that the machine recognizes that no further values will be picked up, and that it can begin the next sample.

When the polling mode is set to 1 with telegram 200, the machine generates a telegram 100 204 upon completion of the sample, which tells the central computer that the data of the sample are available.

When data from every cycle is to be collected (sample interval = 0, sampling mode = 3), it can happen (especially with fast cycle times or a heavily burdened central computer) that not all values will be collected. Such missing values are filled into telegram 304 as ###### according to EUROMAP.

6.7. Telegram 206 Request for Information About Data Collection Mode

The machine answers with the telegram 300 which contains the information about the data collection mode. If after switching the machine control on, or after a receiving a tele-

gram 202 4 (stop) a telegram 200 has not yet been received, the machine answers 306 0 (information not available).

6.8. Telegram 207 x Request for Information About Selected Parameters

x = Group Number. The machine answers with the telegram 301 containing the information about the selected parameters. If after switching the machine control on, or after receiving a telegram 202 4 (stop) a telegram 200 has not yet been received, the machine answers 306 0 (information not available).

7. Functional Limitations due to Machine Control Properties

7.1. Telegrams 007/107 Production Control (Remote Start/Stop of Machine)

For safety reasons (observance of the safety regulations!) the machine does not execute the function 007 1 "remote start of production". The answer is 107 0.

The other functions 007 are implemented, however (see above).

7.2. Telegrams 013/113 Preset Production Counter

This function is not consistent with the topics "quality control and job processing". Problems would arise with quality termination. For this reason the function is not implemented. The answer to a telegram 013 is 113 0 (not accepted).

7.3. Telegram 195 Machine is not Able to Answer

Not implemented, as it is not required with the DSP/4 and DSP/5 controls.
(This telegram was intended only for controls with external Bitbus converter).

8. Quality Data Transfer (Extension to EUROMAP 15)

8.1. General

For the transfer of the quality data Netstal defined a specific telegram set analogous to the one used for data set transfer, which enables the central computer to read the Netstal quality relevant data of the machine control's pages 10/01 (Process Statistics) and 10/03 (Quality Record).

It must be clearly stated that the telegrams needed for the quality data transfer are an **admissible Netstal-specific extension to EUROMAP 15, which may or may not be implemented in a standard EUROMAP central computer**. Prerequisite for the quality data transfer is therefore that the central computer is provided with a Netstal-specific extension.

These quality data are transferred to the central computer only upon its request. The machine control never makes a request to the central computer to retrieve the quality data.

8.2. Central Computer Requests Quality Data

Telegram 560 : Quality Data Request

Byte	Contents	Description
05 .. 08	N4	Quality data selection
	0000	Quality data, set values and tolerances
	0001	Quality data, actual values of the running lot/pallet
	0002	Quality data, actual values of the completed lot/pallet

8.3. Machine Answers Request for Quality Data

Telegram 660 : Reply to Request for Quality Data

Byte	Contents	Description
05	N1	Result of Request
	0	Quality data transfer not possible
	1	Quality data transfer possible

8.4. Central Computer Requests a Data Block

Telegram 561 : Data Block Request

Byte	Contents	Description
05 .. 08	N4	Data block number (first block has number 0000)

8.5. Machine Sends the Requested Data Block

Telegram 661 : Data Block

Byte	Contents	Description
05 .. 08	N4	Data block number Number of the Data block requested by the central computer
09 .. 44	A36	Data block

8.6. Machine Reports End of Quality Data Transfer

Telegram 662 : End of Quality Data Transfer

Byte	Contents	Description
05 .. 08	N4	Data block number Number of the Data block requested by the central computer, although it does not exist (analogous to the EUROMAP procedure for data set upload)

Example: (CC = central computer, IMM = injection moulding machine)

CC:	560	0001		"send me the actual values of the quality data"
IMM:	660	1		"OK, I will send them"
CC:	561	0000		"send me the first Data block"
IMM:	661	0000	U..U	"here is the first Data block with data U..U"
CC:	561	0001		"send me the next Data block with the number 1"
IMM:	661	0001	V..V	"here is the Data block 1 with data V..V"
CC:	561	0002		"send me the next Data block with the number 2"
IMM:	661	0002	W..W	"here is the Data block 2 with data W..W"

...

CC:	561	0017	"send me the next Data block with the number 17"
IMM:	662	0017	"sorry, there is no Data block 17, end of transfer"

8.7. Data Format

The data to be transferred is packed into sequentially numbered blocks of 36 characters each. Depending on the number of digits, one or **more** values (parameters) are packed into a Data block (left adjusted, unused portion of the block is filled with ASCII blank (20 Hex)).

The parameters are transferred like this:

Pxxx=mmm.nn<CR><LF>

or

Pxxx=mmm.nn<CR><LF> [Pxxx=mmm.nn<CR><LF> [Pxxx=mmm.nn<CR><LF>]]

P	:	Parameter name (C, S, T, P)
xxx	:	Parameter number (3 or 4 digits)
mmm.nn	:	parameter value (mmm digits before decimal point, nn digits after decimal point, for whole numbers mmmmmmmm possible, number of digits is variable) Number of digits may differ from one parameter to another.
<CR>	:	Carriage Return (0D Hex)
<LF>	:	Line Feed (0A Hex)
[...]	:	Information within [ ] may or may not be transmitted depending on the free space in a telegram. The characters [and] are **not** part of the telegram.

The following values are transferred:

(see next page)

8.8. Nominal Values of Page 10/01 (Process Statistics) (Act. Lot/ Container)

(requested by telegram 560 0000)

C302	production target	
C303	number of cavities	
C304	admissible number of consecutive rejects	
C305	admissible reject rate	
C306	lot/container size	
C307	number of lots/containers	
C310	lot/pallet change	
C312	job number	
C313	part number	
C314	operator identification	
C330	job mode switch	
C332	reaction to production target	
C340	quality monitoring	
C700	quality termination	
C725	flow index	set value
C726	flow index	tolerance
P326	PM peak value	set value
P337	PI peak value	set value
P426	PM peak value	tolerance
P437	PI peak value	tolerance
S300	start injection	set value
S311	V-p changeover	set value
S319	melt cushion	set value
S400	start injection	tolerance
S411	V-p changeover	tolerance
S419	melt cushion	tolerance
T302	injection time	set value
T311	cycle time	set value
T321	metering time	set value
T402	injection time	tolerance
T411	cycle time	tolerance
T421	metering time	tolerance

If C700 = 0 (no quality completion) the set values and the tolerances are not displayed on the machine screen. They are however transferred to the central computer, but all with a value of 0.

8.9. Actual Values of Page 10/01 (Process Statistics) (Actual Lot/Container)

(requested by telegram 560 0001)

C316 actual contents of the lot/pallet (parts in running lot)
C317 actual lot/pallet (= number of completed lots according to EUROMAP +1)
C318 reject cycle counter (counter for cycles out of tolerance)
C324 parts counter
C325 cycle counter
C326 sample counter
C338 counter for samples out of tolerance

C727	flow index	mean value
C728	flow index	3 * standard deviation
C729	flow index	reject cycles
P427	PM peak value	mean value
P428	PM peak value	3 * standard deviation
P429	PM peak value	reject cycles
P438	PI peak value	mean value
P439	PI peak value	3 * standard deviation
P440	PI peak value	reject cycles
S401	start injection	mean value
S402	start injection	3 * standard deviation
S403	start injection	reject cycles
S412	V-p changeover	mean value
S413	V-p changeover	3 * standard deviation
S414	V-p changeover	reject cycles
S420	melt cushion	mean value
S421	melt cushion	3 * standard deviation
S422	melt cushion	reject cycles
T403	injection time	mean value
T404	injection time	3 * standard deviation
T405	injection time	reject cycles
T412	cycle time	mean value
T413	cycle time	3 * standard deviation
T414	cycle time	reject cycles
T422	metering time	mean value
T423	metering time	3 * standard deviation
T424	metering time	reject cycles

8.10. Actual Values of Page 10/03 (Quality Document) (Completed Lot)

(requested by telegram 560 0002)

C334	quality record number	
C335	from part total	
C336	to part total	
C337	good parts	
C731	flow index	mean value
C732	flow index	3 * standard deviation
C733	flow index	reject cycles
C737	bad parts	
P431	PM peak value	mean value
P432	PM peak value	3 * standard deviation
P433	PM peak value	reject cycles
P442	PI peak value	mean value
P443	PI peak value	3 * standard deviation
P444	PI peak value	reject cycles
S405	start injection	mean value
S406	start injection	3 * standard deviation
S407	start injection	reject cycles
S416	V-p changeover	mean value
S417	V-p changeover	3 * standard deviation
S418	V-p changeover	reject cycles
S424	melt cushion	mean value
S425	melt cushion	3 * standard deviation
S426	melt cushion	reject cycles
T407	injection time	mean value
T408	injection time	3 * standard deviation
T409	injection time	reject cycles
T416	cycle time	mean value
T417	cycle time	3 * standard deviation
T418	cycle time	reject cycles
T426	metering time	mean value
T427	metering time	3 * standard deviation
T428	metering time	reject cycles

9. Parameter Change Log Transfer (Extension to EUROMAP 15)

9.1. General

If implemented on a particular moulding machine the parameter change log is a queue containing all nominal parameter changes. For the transfer of this queue entries Netstal defined a specific telegram set.

It must be clearly stated that the telegrams needed for the parameter change log transfer are an **admissible Netstal-specific extension to EUROMAP 15, which may or may not be implemented in a standard EUROMAP central computer and may or may not be supported by a particular moulding machine**. Prerequisite for the parameter change log transfer is therefore that the central computer is provided with a Netstal-specific extension and the moulding machine is supporting these telegrams.

These parameter change log entries are transferred to the central computer either upon its request or by request of the machine after a parameter change has been logged. As the parameter change queue is transferred entry by entry only one central computer can be active for parameter change log transfer.

9.2. Register for Parameter Change Log Transfer

Telegram 570 : Central Computer Registers for Parameter Change Log

Byte	Contents	Description
05	N1	Control of parameter change logging
	0	Logging will be turned off
	1	Logging will be turned on
	2	Just register but don't change the logging state
06 .. 10	N5	Size of parameter change logging queue
	0	Don't change the size of the queue just query it
	1 .. 1000	New change logging queue size

Telegram 670 : Machine response to Register for Parameter Change Log

Byte	Contents	Description
05	N1	Result of parameter change logging registration
	0	Registration failed
	1	Central Computer successfully registered
06	N1	Current state of parameter change logging (C1040)
	0	Logging is turned off
	1	Logging is turned on
07 .. 11	N5	Actual size of parameter change logging queue (C1041)
	1 .. 1000	Change logging queue size

Once a central computer successfully registered for "Parameter Change Log Transfer" it will receive requests for "Parameter Change Log Transfer" (telegram 571) in replies to standard question telegrams whenever new entries have been added to the parameter change log and the log was empty before.

If there is already a central computer registered for “Parameter Change Log Transfer” further requests from other central computers to register are rejected. In this case the machine response with telegram 670 with first character set to zero (0 = Registration failed). The central computer already registered can call the telegram again to change the logging configuration.

9.3. Parameter Change Log Transfer

Telegram 571 : Central Computer Requests Next Parameter Change Log Entry

Byte	Contents	Description
05 .. 14	N10	Identification of the last transferred log entry
	0	Identification unknown (transfer head of queue)
	> 0	Valid identification of last transferred log entry

Telegram 671 : Machine response with Next Parameter Change Log Entry

Byte	Contents	Description
05 .. 14	N10	Identification of the log entry
15 .. 34	A20	Identification of the changed parameter
35 .. 94	A60	Short description of the changed parameter in the screen language used on the machine
95 .. 134	A40	Old value of the changed parameter
135 .. 174	A40	New value of the changed parameter
175 .. 184	A10	Unit of measurement (e.g. bar, mm, % etc.)
185	N1	Originator of the change
	0	Operator
	1	Host Computer
	2	Machine
186 .. 205	A20	Identification of the user (operator) logged in at the machine, when the parameter was changed
206 .. 215	A10	Date of the change (Format yyyy.mm.dd)
216 .. 223	A8	Time of the change (Format hh:mm:ss)
224 .. 233	N10	Cycle number (value of parameter C325) at the time of change
234 .. 238	N5	Number of remaining queue entries including the current one

After receiving of a valid identification of last transferred log entry the machine is deleting the corresponding entry from the change log queue.
If an invalid identification of last entry is received the machine returns the head of the queue.
If the queue is empty when receiving a request the machine returns an empty entry (all strings blank, all numbers zero).
If the central computer calling this telegram is not registered for parameter change log transfer (see 9.2) it will receive an error 196 telegram.

Example of protocol flow :

Machine		Host
	←	Request telegram (Log-entry id = 0)
Response telegram (Log-entry id = 4711, ...)	→	
		Process log data
	←	Request telegram (Log-entry id = 4711)
Delete log entry with id = 4711		
Response telegram (Log-entry id = 4712, ...)	→	
		Process log data
	←	Request telegram (Log-entry id = 4712)
Delete log entry with id = 4712		
Response telegram (Log-entry id = 4713, ...)	→	...
		...
	←	Request telegram (Log-entry id = 0)
Response telegram (Log-entry id = 4713, ...)		
		Process log data
		Request telegram (Log-entry id = 4713)
...		...

10. Extended Settings Support (Extension to EUROMAP 15)

10.1. General

To support extended settings like the string encoding or telegram size Netstal defined an additional set of telegrams.

It must be clearly stated that all telegrams described in this chapter are **admissible Netstal-specific extension to EUROMAP 15, which may or may not be implemented in a standard EUROMAP central computer and may or may not be supported by a particular moulding machine**. Prerequisite for these telegrams is therefore that the central computer is provided with a Netstal-specific extension and the moulding machine is supporting these telegrams.

10.2. Set / Query Actual Encoding

In the standard implementation of EUROMAP 15 only printable ASCII characters from 20 hex to 7E hex are allowed. If the extension described in this chapter is implemented on a particular moulding machine it is possible to use ASCII characters 20 hex to FF hex using codepage 1252 for most string values in the standard telegrams. This encoding of telegrams is controlled via parameter C1042 and can be set or queried by the telegram described in this chapter.

Telegram 580 : Central Computer Set / Query Actual Encoding

Byte	Contents	Description
05	N1	Selected Encoding
	0	Using standard EUROMAP 15 encoding (printable ASCII characters 20 hex to 7E hex)
	1	Using extended encoding (printable ASCII characters 20 hex to FF hex using codepage 1252)
	2	Don't change encoding just query it

Please note that the moulding machine never replies to a standard question telegram with a request for "Set / Query Actual Encoding".

Telegram 680 : Machine response to Set / Query Actual Encoding

Byte	Contents	Description
05	N1	Actual encoding (C1042)
	0	Using standard EUROMAP 15 encoding (printable ASCII characters 20 hex to 7E hex)
	1	Using extended encoding (printable ASCII characters 20 hex to FF hex using codepage 1252)

10.3. Register for Data Set Transfer

As an extension to EUROMAP 15 Netstal defined a specific telegram to explicitly register for data set transfer. It is intended to support environments with multiple central computers connecting to a single moulding machine. With the standard EUROMAP 15 implementation of data set transfer the behaviour of the moulding machine connected to multiple central computers is not clearly defined when the data set transfer is initiated on the moulding machine.

Telegram 581 : Central Computer Registers for Data Set Transfer

This telegram contains no additional data bytes.

Telegram 681 : Machine response to Registers for Data Set Transfer

Byte	Contents	Description
05	N1	Result of data set transfer registration
	0	Registration failed
	1	Central Computer successfully registered

If an other host computer is already registered for data set transfer the machine will response with a result code of 0 (“Registration failed”).

10.4. Register for Large Telegrams for Part 3 and 4

In the standard implementation of EUROMAP 15 the telegram length is limited to 45 bytes. If the extension described in this chapter is implemented on a particular moulding machine it is possible to transfer larger telegrams up to 1024 bytes. Please note that this feature is only available for data set transfer (EUROMAP 15 Part 3) and variable transfer (EUROMAP 15 Part 4).

Telegram 582 : Central Computer Set Large Telegrams

Byte	Contents	Description
05 .. 09	N5	Requested telegram size for data set transfer (Part 3)
	0	Use standard telegram size
	1	Use the largest supported telegram size
	2	Don’t change telegram size just query it
	> 45	Use the supplied telegram size
10 .. 14	N5	Requested telegram size for variable transfer (Part 4)
	0	Use standard telegram size
	1	Use the largest supported telegram size
	2	Don’t change telegram size just query it
	> 45	Use the supplied telegram size

Telegram 682 : Machine response to Set Large Telegrams

Byte	Contents	Description
05 .. 09	N5	Actual telegram size for data set transfer
10 .. 14	N5	Actual telegram size for variable transfer

Please note that a new dataset telegram size will be active only upon next start of data set transfer. A currently active dataset transfer is not affected by this telegram.

10.5. License based activation of EUROMAP 15 interface

If not ordered as an option the EUROMAP 15 interface is inactive on the machine. If the extension described in this chapter is implemented on a particular moulding machine it is possible to activate the EUROMAP 15 interface based on a license file received from Netstal for the particular moulding machine.

Telegram 583 : Central Computer Activate Interface

Byte	Contents	Description
05 … xx	Bxx	Content of License file as received from Netstal

Telegram 683 : Machine response to Activation Request

Byte	Contents	Description
05	N1	Result of the interface activation request
	0	The activation request failed
	1	The activation request was successful
06 .. 07	N2	Error code of activation request
	0	No error, activation request was successful
	1	The machine number does not match
	2	The activation date is invalid
	9	General activation error
08 .. 17	A10	Expiration date of activation if temporary activated. --.--.---- if the license has no time limit

If the received license file is not valid (e.g. signature violation) a telegram 197 with a reason code of 2 is returned.