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1 Introduction

This manual describes the operator terminals *MAC 10/MTA-10* and *MAC 12/MTA-12*. Hereafter these products are referred to as the terminal. In the manual we refer to the software package *MAC Programmer+ / SW-MTA-WIN* for Windows and *MAC Programmer/SW-MTA* for DOS. Hereafter these products are referred to as the PC software.

The operator terminal is developed for use with the MELSEC FX0 and FX PLC system to simplify man-machine communication.

The functions incorporated in the terminal include those for displaying text with dynamic values, for maneuvering objects and for time channel control.

Programming of the terminal is achieved by means of a personal computer and the PC software. In *MAC 10/MTA-10* you can use the pre-programmed application supplied as a part of the product.

In addition to the sections describing the functions found in the terminal and installation of the terminal, there is a section on how to use the pre-programmed application and another on how to use the PC software to program the terminal. Several useful *programming examples* and a *reference guide* are found in this manual.

When combined, the terminal and an FX0 PLC form an integrated system for completely replacing hard-wired timers, counters and relays used in very small automation applications such as individual machine control.

2 Installation

2.1 Contents of package

The terminal package includes:

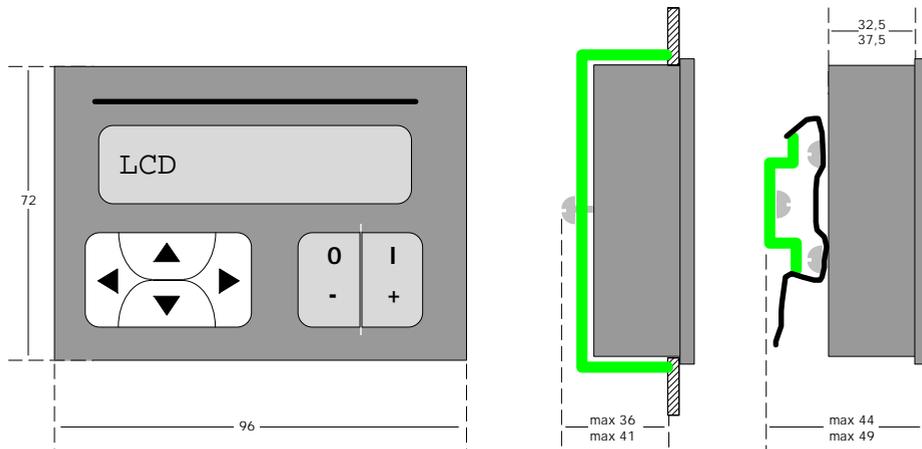
- Terminal
- Installation manual

2.2 System requirements

The terminal works with Mitsubishi's programmable logic controllers series MELSEC FX0/FX0N and FX.

2.3 Mounting

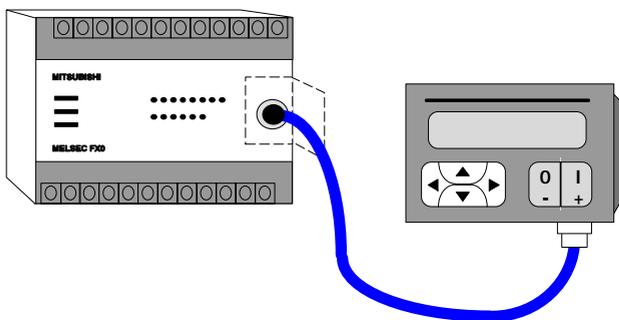
The terminal can be mounted on a panel or on a DIN rail. To comply with IP65 environmental standard, the terminal should be mounted in a front panel.



The different ways of mounting the terminal

2.4 Connection to FX0/FX0N

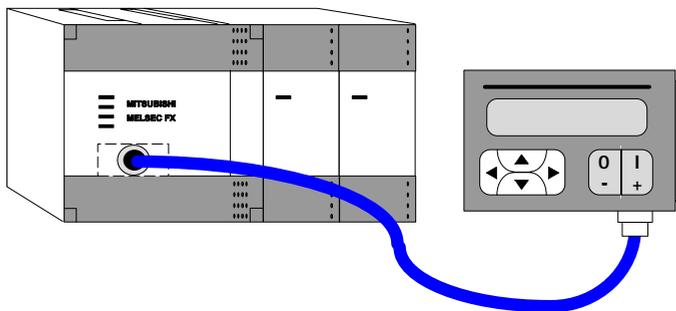
The terminal is supplied with an 8-pin Mini-DIN cable for connection to a FX0 PLC system. The cable is straight; the contact at each end is compatible with both the terminal and the FX0 system. The terminal connector is located in the bottom of the unit, and the FX0 connector is located under a protective cap in the top of the unit. The cable has a maximum length of 3 m and communication speed is 9600 baud. The terminal is powered by the FX0 system via the cable supplied. If a longer cable is required, the terminal must be powered from a source other than the FX0 PLC.



Connection of the terminal to FX0 system

2.5 Connection to FX

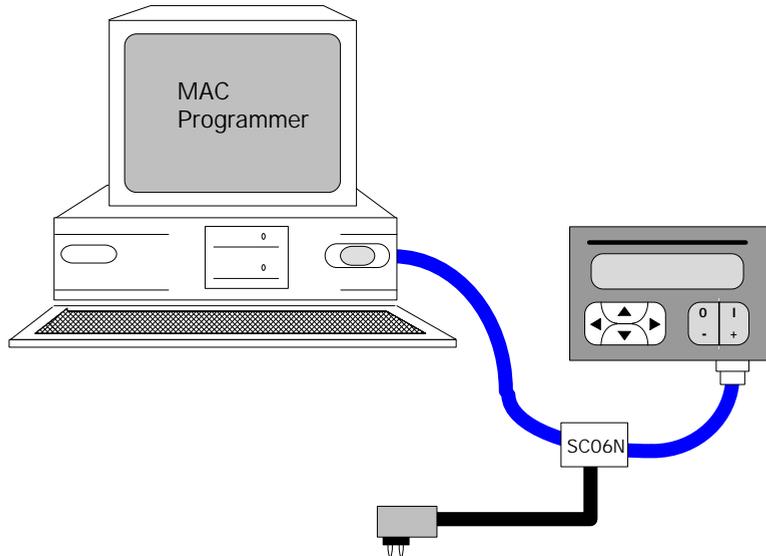
Cable FX-20P-CABN must be used to connect the terminal to a FX PLC system. For other conditions see connection to FX0.



Connection of the terminal to FX PLC system

2.6 Connection to a Personal Computer

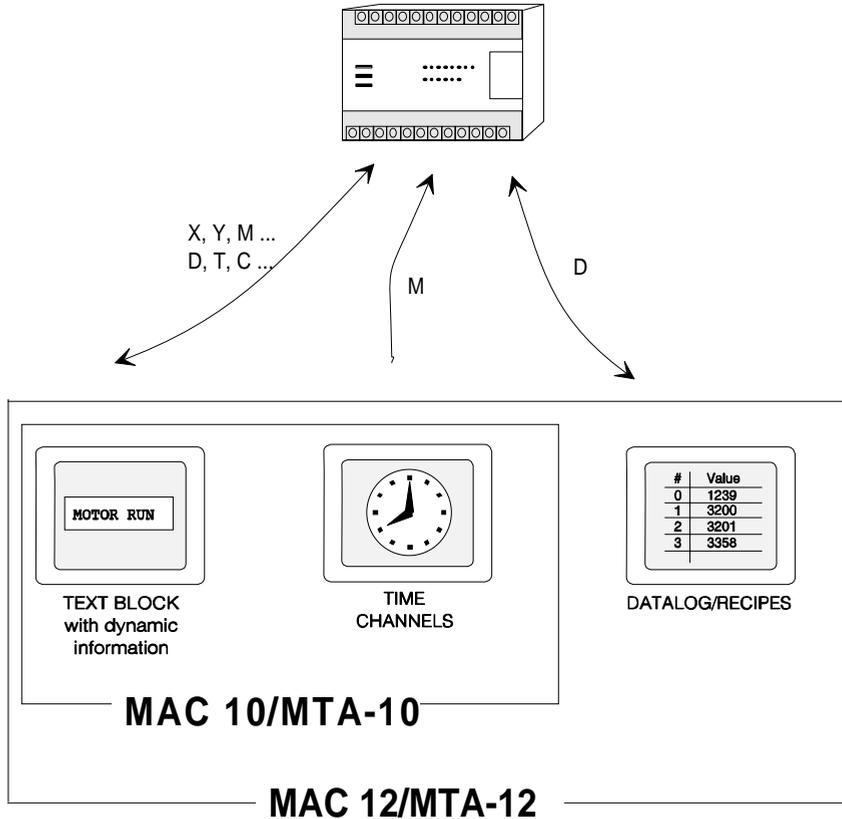
Connection can be made using a SC06N adapter. The maximum cable length is 3 m and the communication speed is 9600 baud.



Connection of the terminal to a personal computer

The terminal is programmed using a personal computer with the PC software. You also use the PC software to make a backup of the terminal project. Later it is also possible to transfer the project to other types of terminals, for example a MAC 50/MTA-250.

3 Function overview



3.1 Basic definitions

Textblock

Textblock are used to create and structure an application. Textblocks can consist of an unlimited number of lines of up to 16 characters long.

Static text

Static text is text which is written in textblocks and which cannot be changed during RUN-mode.

Dynamic objects

Dynamic objects are those objects which are linked to signals in the PLC system. There are 7 types of dynamic objects: digital, analog, jump, date/time, bar graph, multiple choice and text object.

Time channels

Time channels make it possible to set a digital signal ON or OFF controlled by the real time clock, that is, to enable you to ensure that a certain function is ON during certain periods of the day.

Data logging/menu

A part of the project memory in the terminal is set aside for logging data or storing menus.

4 How to program the terminal

This section describes how you can program the terminal with the PC software for Windows (programming can also be done with MAC Programmer for DOS). Refer to the PC software manual for further information. An example will be used later in this section to clarify how the terminal is programmed.

4.1 Communication mode

The terminal must be in mode "Communication with PC software" before a program can be transferred from the PC software to the terminal. To set the terminal into this mode press the [←] [-] keys down continuously during power-up of the terminal.

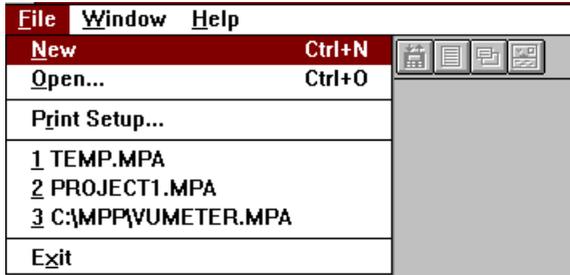
4.2 Keyboard

The terminal keyboard incorporates 6 membrane keys which are used to perform the following functions:

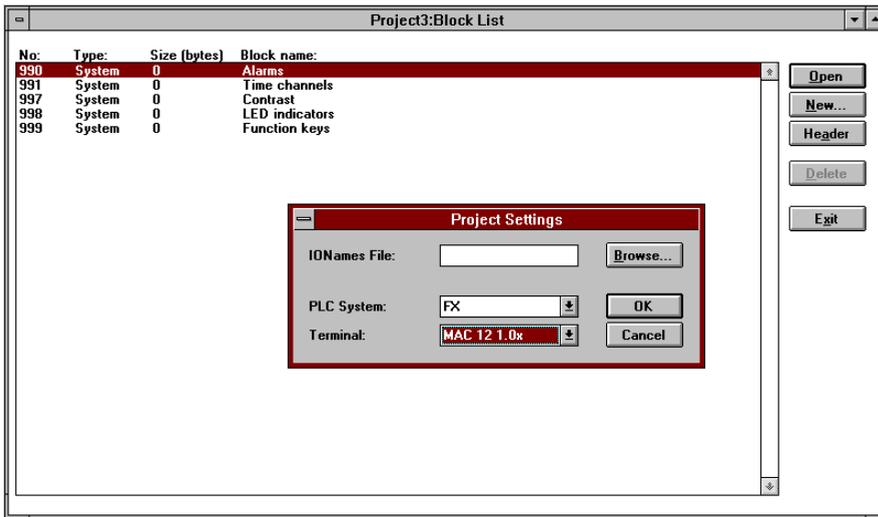
	Set manoeuvrable digital object (ON). Increase value of manoeuvrable analog object. Execute jump. Select/execute choice from a multiple choice object.
	Reset manoeuvrable digital object (OFF). Decrease value of manoeuvrable analog object.
	Move up one line. If the first line of time channel settings: return to previous level.
	Move to next field (position).
	Move to previous field (position).
	Move down one line.

4.3 Creating a project

Create a new project in the PC software by selecting New from the File menu.



Make entries for the project according to the figure below.



See the PC software manual for further information.

4.4 Text and system blocks

The main functional tool in the terminal is textblocks. These are used for building up applications. Textblocks are used to build up individual menus, between which you can define jumps. Textblocks can also present the status and value of different signals.

A textblock can contain an unlimited number of lines, each of up to 16 characters in length. Textblocks are defined using the PC software on a personal computer.

Each block has its own identity number. The first block, the one that is displayed on power up, is always number 0. This block is also called the "Main menu". The following blocks are numbered from 1 to 999. The block numbers 990-999 are reserved for system blocks. Block number 991 is used in the terminal for the time channels.

Select New in the block list. Now the block header is displayed. The following parameters can be assigned to textblocks:

Block no:

Type in a block number or press [F9] to select from a menu. The first text block of a project must be assigned the number 0.

Block name:

Type in any name of your choice for the textblock. The name can be up to 15 characters long. The name is optional.

Block width:

Line length is 16 characters, this cannot be altered.

Display signal:

You can assign a signal which is used by the PLC-program to display the textblock. The textblock is displayed when the signal is activated.

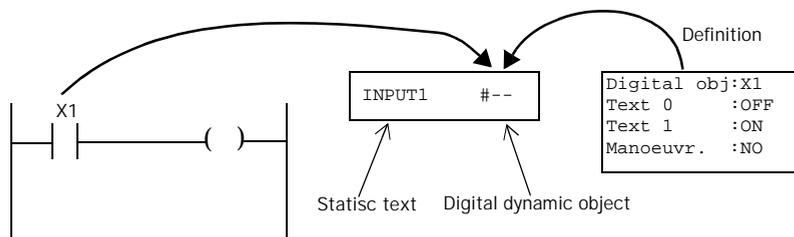
Status

This is where you can define the status word for the textblock. Press the button Status.. to display a list of those functions which influence the status words displayed. Functions can be assigned by selecting either YES or NO. The status words displayed will depend on the combination of YES and NO you select. See *Reference Guide* for information on the functions that effects the status word.

When you have completed parameter setting, press [OK] to edit textblocks. See the PC software user manual for more information.

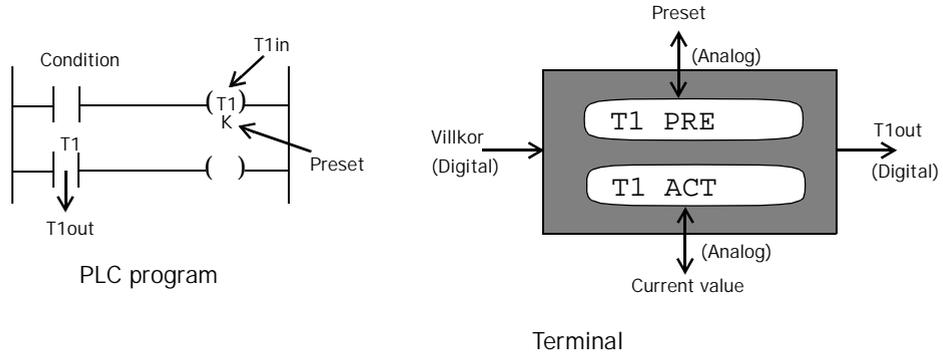
4.5 Static and dynamic information

You can manipulate two types of information in textblocks, static text and dynamic data object. Static text does not change during the execution of a program. There are 7 types of dynamic object: digital, analog, jump, date/time, bar graph, multiple choice and text. The character # defines a dynamic field. The diagram below shows how a channel number can be linked to a dynamic object in a project.



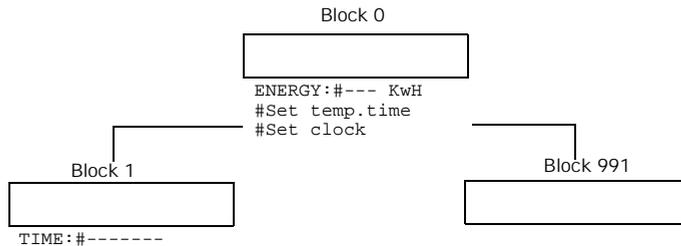
The timers and counters in FX0, FX0N and FX have four different values; input condition, output status (digital), preset value and actual value. When the PLC program is written it is clear which value that is referred, due to the position in the relay ladder diagram.

When the terminal should access the preset or actual value it must be defined with PRE or ACT. When a timer or counter is used in a digital object, it will always display the status of the output.



4.6 Example: Temperature control

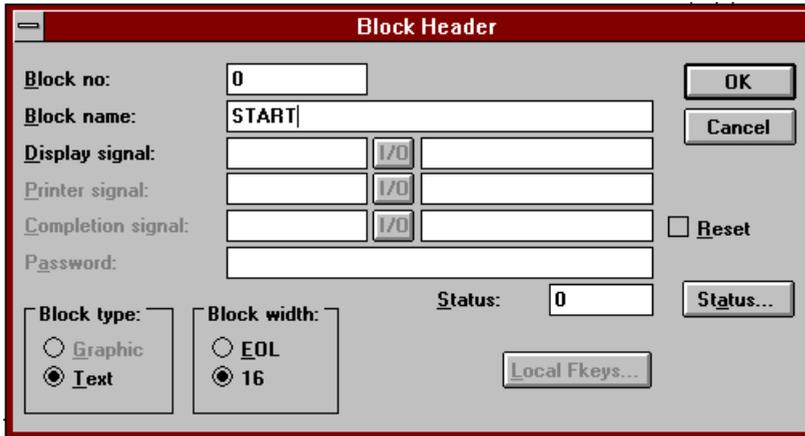
This example shows how to create an application for energy conservation. The temperature setpoint will be alternated due to the time of day. A time channels is used to set the interval for day temperature. You will also see how you can read the energy consumption in kWh.



Schematic diagram of a project

Menus

Select New in the block list. Set the parameters for a textblock according to the picture below.



Block Header

Block no: 0 OK

Block name: START Cancel

Display signal: 1/0

Printer signal: 1/0

Completion signal: 1/0 Reset

Password:

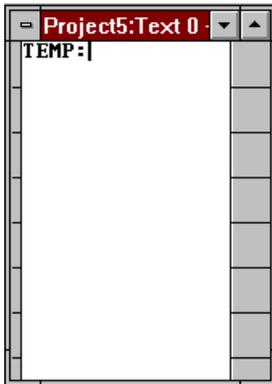
Block type: Graphic Text

Block width: EOL 16

Status: 0 Status...

Local Fkeys...

Press [OK] to edit a textblock. Type in the following text on the first line
TEMP:



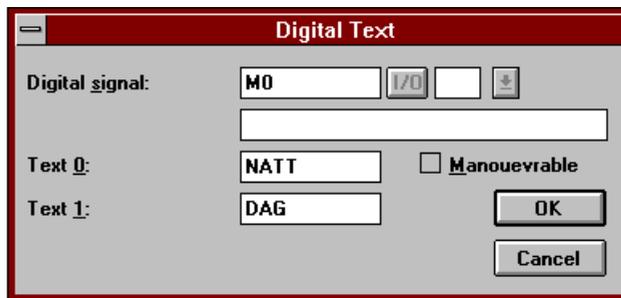
Project5:Text 0

TEMP:|

Select Digital text (0/1) in the toolbox..



A dialog box is now displayed to allow you to define the object. Fill in the dialog box according to the picture below.



Finish by pressing [OK]. Type the text LEVEL and finish with [Enter]. The first line is now complete and the cursor moves to the next line.

Line 2

Type in ENERGY on the second line. Select Analog object (0,3) in the toolbox. Fill in the dialog box according to the picture below and finish with [OK].

The screenshot shows a dialog box titled "Analog Numeric". It has a close button in the top-left corner. The fields are as follows:

- Analog signal: D0 (with I/O and dropdown icons)
- Positions: 4 (with a "Manoeuvrable" checkbox)
- Decimals: 0
- Minimum value: 0
- Maximum value: 9000
- Offset: 0.
- Gain: 1.

Buttons: OK, Cancel

Type in the text kWh and finish the line with [Enter].

Line 3

Select Jump object in the toolbox. Fill in the dialog box according to the picture below and finish with [OK].

The screenshot shows a dialog box titled "Jump to Another Block". It has a close button in the top-left corner. The fields are as follows:

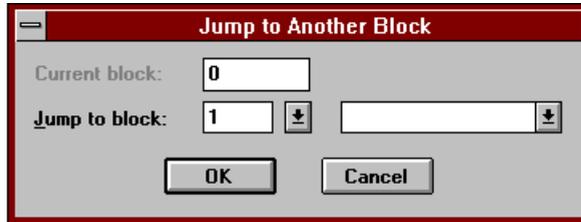
- Current block: 0
- Jump to block: 991 (with a dropdown arrow)
- Time channels: Time channels (with a dropdown arrow)

Buttons: OK, Cancel

Type in the text Set temp.time. End the line with [Enter].

Line 4

Select Jump object in the toolbox. Fill in the dialog box according to the picture below and finish with [OK].

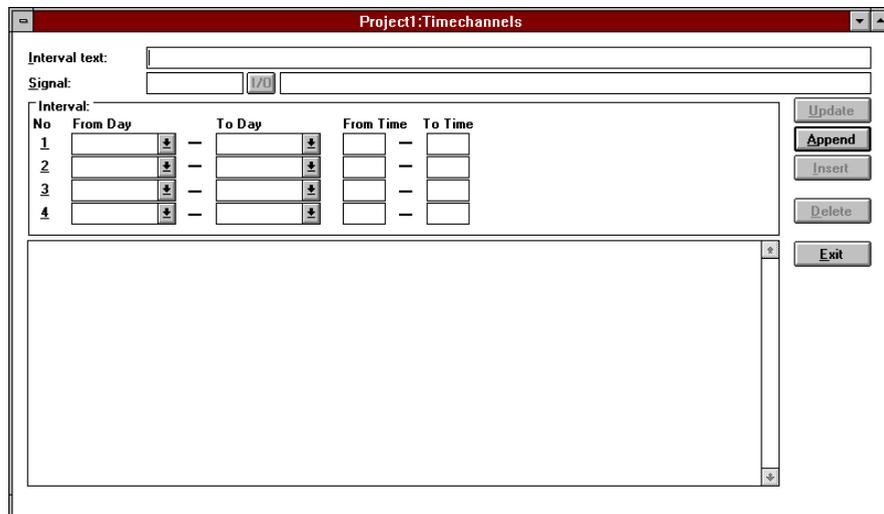


Type in the text Set clock. End the line with [Enter].

Time channels

Time channels in the terminal make it possible for you to instruct that a certain signal should be ON during certain times of the day. Each time channel can have four time intervals.

Select Time channels in the View menu. The following will be presented.



Define the time channel according to the following figure. In the dialog you enter the signals that must be set to 1 and define the time intervals when the day temperature is in operation.

No	From Day	To Day	From Time	To Time
1	Monday	Friday	0700	1700
2	Saturday	Sunday	1200	1600
3				
4				

End definition by pressing [Append]. Return to the block list by pressing [Exit].

Textblock for Date/Time

Select New in the block list. Enter the block number 1 and press [OK].

Type DATE:. Select the object Date/time in the toolbox. Carry out parameter setting for the objects according to the following figure. End with [OK].

Day of the week Manoeuvrable

Date

Time

OK

Cancel

Press [Enter] to change line. Type in TIME: on the second line. Select the object Date/time in the toolbox. Carry out parameter setting for the objects according to the following figure.



End with [OK].

Note!

Date/time is set in run mode using this type of textblock. See example Operating machine status.

4.7 Transferring a project

Projects can be transferred between a terminal and a personal computer when the terminal is in communication mode. This mode is selected by pressing the [←] [-] keys down continuously during terminal power-up. For more information see section *Transferring an application* in the chapter *Reference guide*.

4.8 Run mode

Run mode is selected automatically on power-up. In run mode you can display function status and control a process according to the application in the terminal. For more information see section *Run mode* in the chapter *Reference guide*.

5 Databuffer

MAC 12/MTA-12

This function means that an area of the battery memory is used as an extra memory bank for the PLC system. The PLC program determines what is to be read/written as well as when/where it is to be done.

The size of the memory bank is configured in the terminal. The available buffer area depends on how much project memory is used (maximum project memory is 8000 bytes).

The PLC program communicates with the memory bank in the terminal via a data control block (4 registers) in the PLC system. The position in the memory area to read from or write to is stated with an index.

Index	Memory bank
0	Value 1
1	Value 2
-m	Value m+a

5.1 Configuration in the terminal

The address in the terminal is configured to the first data control register in the PLC system (see the next section) as is the size of the memory bank (in number of registers, 2 bytes per register).

The parameters are defined in the PC software. Select Databuffer Setting in the Setup menu and make the settings according to the following figure.

The screenshot shows a dialog box titled "Databuffer Setting". It has a close button in the top-left corner. The dialog contains the following fields and controls:

- Control block reg:** A label followed by a text box containing "D10", a button labeled "I/O", and an empty text box.
- Read reg:** A label followed by an empty text box, a button labeled "I/O", and another empty text box.
- Buffer size:** A label followed by a text box containing "1000".
- At the bottom, there are two buttons: "OK" and "Cancel".

5.2 Data control block in the PLC system

The data control block consists of 4 registers:

Register	Description
Dn0	Command register.
Dn1	Start index in the memory bank to read from/write to.
Dn2	Number of registers to read/write.
Dn3	Start register in the PLC system to read from/write to. (e.g. if 100 is stated in this register, reading/writing will begin in register D100).

The command register is set in the PLC system and can assume the following values:

- 1 Write to memory bank
- 2 Read from memory bank
- 3 Fill the selected area with the value found in Dn3

The terminal replies in the same register in a similar way to the following:

- 0 Reading/writing completed
- FFFF Error when reading/writing

6 "Joystick" function

MAC 12/MTA-12

With this function it is possible to use the arrow keys as function keys. On the command line under System signals you enter the command AK and an address. For example you can enter AKM100 (the command AK and memory cell M100).

Then M100 is the enable signal and the following 4 memory cells are as according to the following control block.

Memory cell	Description
Mn0	Enable. Arrow key detection. Disable=normal function.
Mn1	Left key
Mn2	Down key
Mn3	Up key
Mn4	Right key

If you press an arrow key when the enable signal is set the memory cell corresponding to the key pressed will be set. When the enable signal is set the normal functions of the arrow keys are disabled.

6.1 Example

The following example can be used to exit the joystick function and return to normal function. Make the following steps.

- create a block with 1:st man obj defined.
- enter the static text "JOYSTICK".
- create a digital object with the following settings:

```
D.Signal: M100  
Text 0  : OFF  
Text 1  : ON  
Manoeuvr: YES
```

The block will look like this:

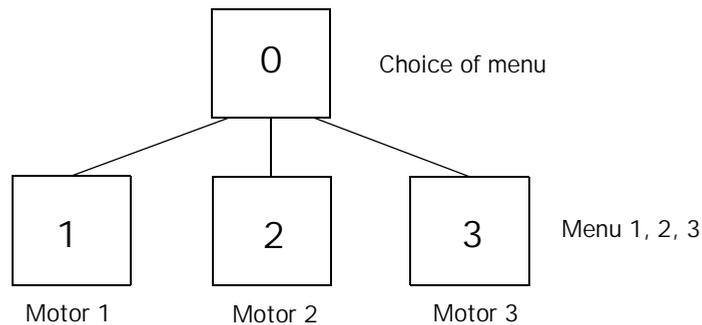
```
JOYSTICK #--
```

7 Programming example

When planning an application there are a number of things to take into consideration. For instance, which blocks should you use and how do you change blocks? We will now try to answer some questions that may arise.

7.1 Structuring textblocks according to application

Signals linked to the same object are normally shown together. Suppose we have an application involving 3 motors. The following menu tree can then be made for the blocks:



For instance, block 2 would look like:

MOTOR 2 IS ON	-digital value
RUN TIME: 20 MIN	-timer value

7.2 Changing text block on display

The possibilities that exist for moving between different blocks in Run mode are defined by the application in the terminal, perhaps in conjunction with the PLC program. Note that there may be several ways of moving to a particular block.

Jumping between blocks

Make a jump object in the displayed block and use it to jump to another block. This function is completely independent of the PLC program.

Block changing controlled by the PLC program

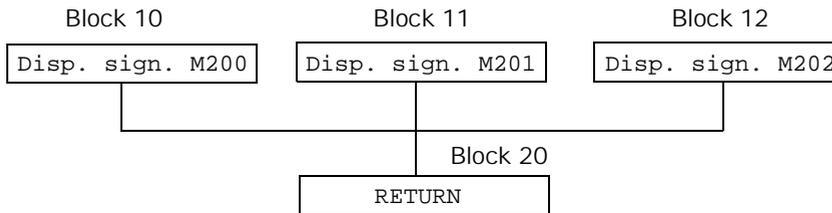
When selecting a textblock, define the digital signal that, when activated, displays the text block. In this example we define that text block 5 is displayed when signal X0 is activated.

The screenshot shows a dialog box titled "Block Header" with the following fields and controls:

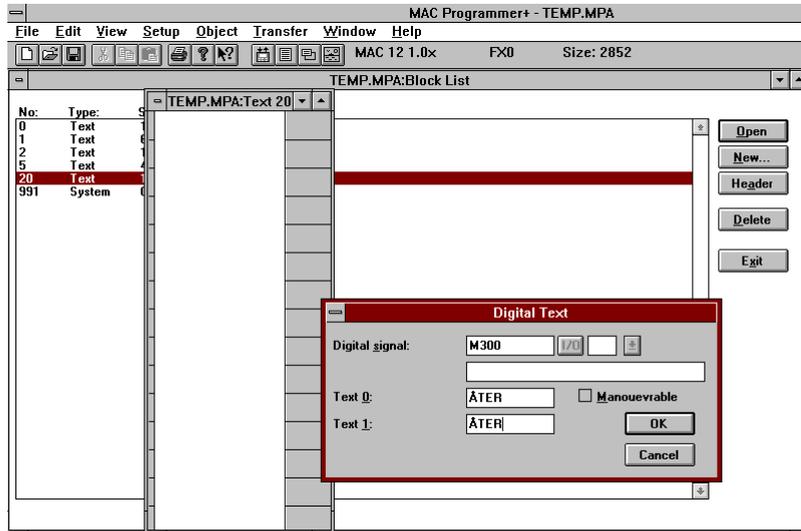
- Block no.:** 5
- Block name:** (empty text field)
- Display signal:** X0 (with I/O selection buttons)
- Printer signal:** (empty text field with I/O selection buttons)
- Completion signal:** (empty text field with I/O selection buttons)
- Password:** (empty text field)
- Block type:** Radio buttons for Graphic and Text (Text is selected).
- Block width:** Radio buttons for EOL and 16 (16 is selected).
- Status:** 0
- Buttons: OK, Cancel, Reset, Status..., Local Fkeys...

Returning to the previous block used

We are in block 20 and want to jump back to the previous block (10, 11 or 12) we were using.



M200-M202 are the display signals for blocks 10-12. In block 20 we make a digital object:

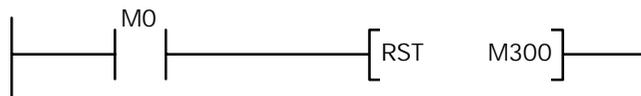


To move to block 20 we make jump objects in blocks 10-12.

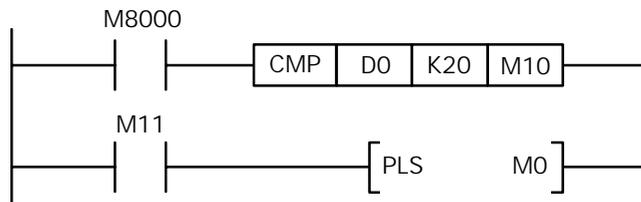
The PLC program looks like this:

D0 = current block

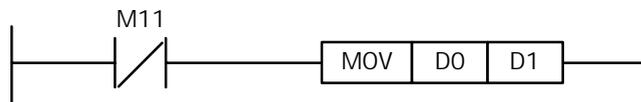
D1 = the block displayed before block 20



Check if D0=20

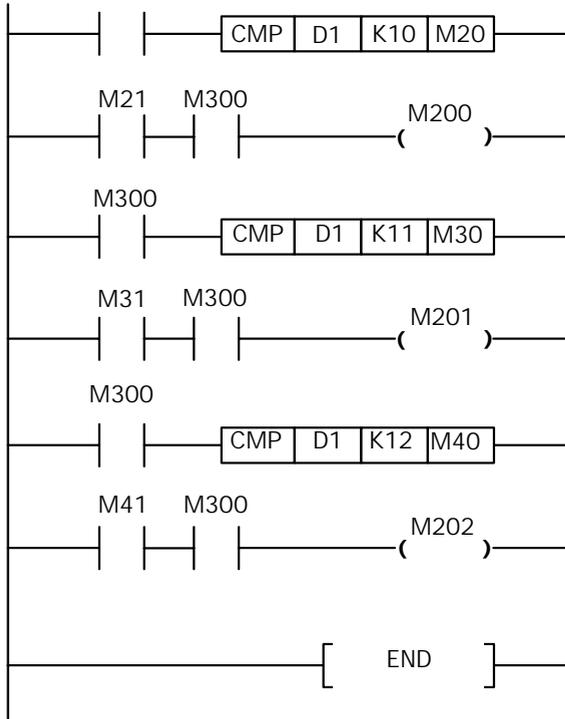


Transfer D0 to D1



Programming example

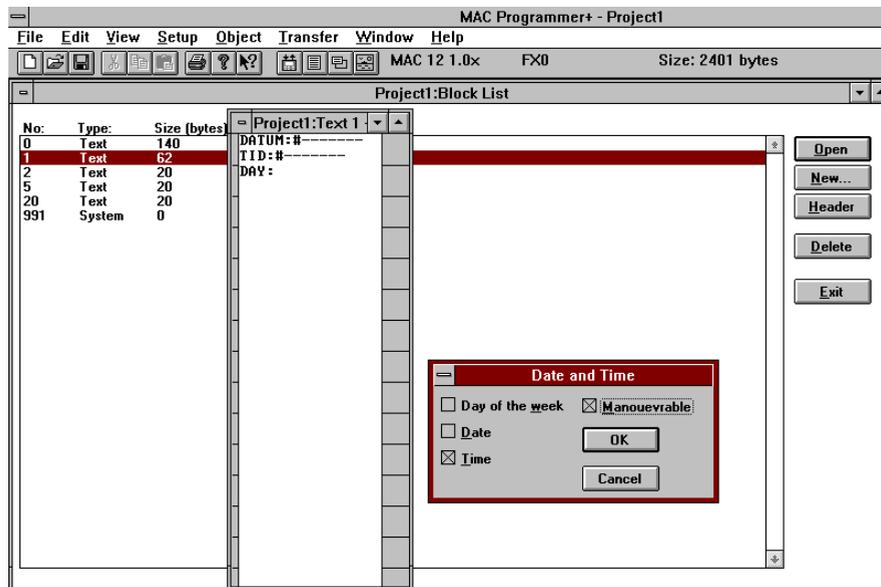
When M300 is activated we compare D1 with K10-K12 to know which block to jump back to.



7.3 Setting date and time

To set the right date and time in Run mode, you have to create a manoeuvrable date/time object in a block. If you only want to change the date or time you must create 2 object to avoid problems with the cursor in Run-time mode - one with date only and one with time only.

If you want to show a weekday as well, you have to create a third block with the day of the week only. You can never change a weekday, this is automatically calculated from the date entered.



It is possible to have manoeuvrable date/time objects in several blocks. Of course, a change in one block will then affect those in other blocks.

Note that setting the format for date and time is carried out in configuration mode.

Note!

The real-time clock can handle the years from 1970 to 2035. If you type in 00 this means the year 2000. If you want to enter the year 1993, press the [-] until 93 is displayed. If you want to enter the year 2010, press the [+] until 10 is displayed.

7.4 Control by time

Use a time channel to control a signal.

Note!

If the digital signal linked to the time channel exists in the program as an OUT instruction, the PLC program takes command. If this condition is not valid then the signal remains inactive.

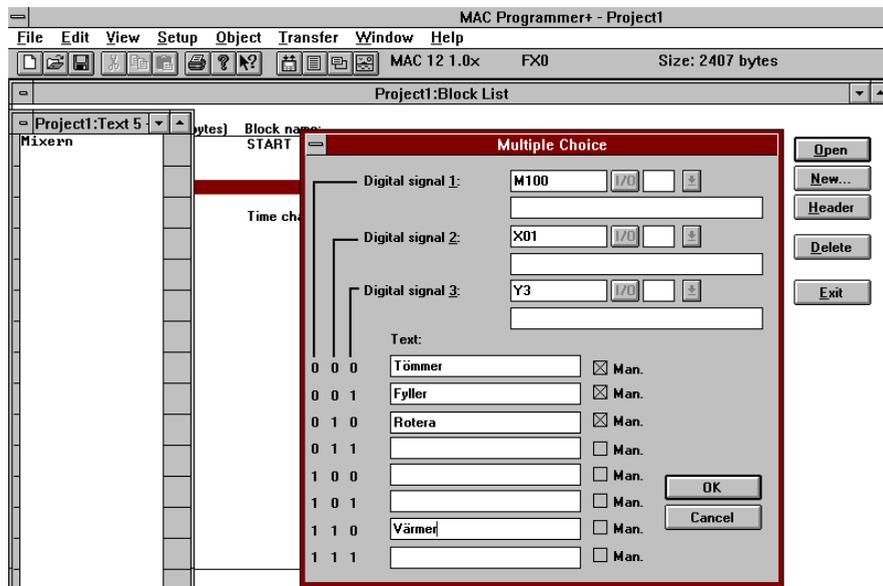
Changing time channel intervals on-line

To make it possible to change time channel intervals during Run mode, you must select YES for time channels under *Online changes* in Set-up mode.

To change intervals on-line, jump to block 991 (system block for time channels).

7.5 Operating machine status

In this example we have a mixer with functions for emptying, filling, rotation and heating. It is not possible to force a heating value.



By typing in YES for Man 000:, Man 001:, and Man 010: it is possible to force these statuses. A NO for Man 110 means that you cannot force this status.

	Status	D.Obj 1	D.Obj 2	D.Obj 3
Text 000	Emptying	0	0	0
Text 001	Filling	0	0	1
Text 010	Rotate	0	1	0
Text 011		0	1	1
Text 100		1	0	0
Text 101		1	0	1
Text 110	Heating	1	1	0
Text 111		1	1	1

7.6 Selection list

In this example we want to check the status of a certain pump. A selection causes a jump to the textblock in which data for the pump is collected on-line.

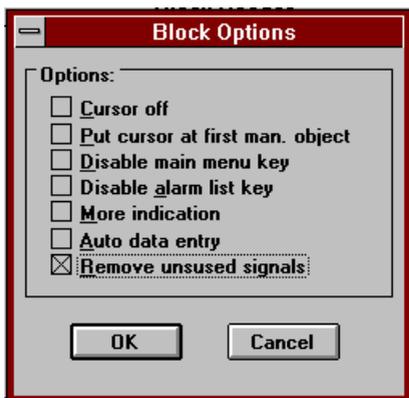
```
- SELECT PUMP -
#PUMP 1
#PUMP 2
#PUMP 3
```

The textblock in programming mode

When the textblock with selection list is displayed, we want the cursor to be positioned on the first jump object, not the top left corner in Run mode. We therefore type in YES for the 1:st man obj of the status word menu.

7.7 Dynamic text blocks

By setting the status *Remove not used signals* for a textblock the same text-block can be used for different but similar applications. For example, a project can consist of 10 lines for setting preset values, 0-10, but in the PLC program only presets 2-5 are used. If the status *Remove not used signals* is set, only those lines with selected presets will be displayed, that is, 2-5.



7.8 How much can be stored for a project

A maximum of 3900 bytes in MAC 10/MTA-10 and 8000 bytes in MAC 12/MTA-12 can be stored for a project application. This amount can be divided freely into different functions. The list below shows how many bytes each function requires:

Function	Bytes required
Textblock	20
Static text in block	16 per line
Digital object	24
Analog object	29
Jump object	6
Date/Time object	8
Bargraph object	29
Multiple choice object	85
Text object	10
Time channel	63

8 Reference guide

This section gives a general description of the different function found in the terminal.

8.1 Project memory size

The project memory size in MAC 10/MTA-10 is 3900 bytes and in MAC 12/MTA-12 the memory size is 8000 bytes.

8.2 Mode selection

The terminal normally enters Run mode during power-up.

The table below shows the other modes possible with the terminal. Keep the following keys pressed during terminal power-up to enter the required mode:

MAC 10	MAC 12	Function
 		Select language and preprogrammed project.
 	 	Transfer of application to/from PC.
 		Set-up mode
 		PLC program transfer
 	 	Erase memory
 	 	Terminal self test

8.3 Set-up of the terminal using the PC software

Signals

Setting handshake signals between the terminal and a PLC

The screenshot shows a dialog box titled "System Signals". It contains the following fields and controls:

- Current display reg: [input field] [I/O] [input field]
- New display reg: [input field] [I/O] [input field]
- Printer busy signal: [input field] [I/O] [input field]
- Buzzer signal: [input field] [I/O] [input field]
- VF luminance reg: [input field] [I/O] [input field]
- Backlight signal: [input field] [I/O] [input field]
- Reverse signal: [input field] [I/O] [input field]
- No prot. ctrl. reg: [input field] [I/O] [input field]
- Cursor. ctrl. reg: [input field] [I/O] [input field]
- Commands: [input field]
- Buttons: OK, Cancel

Select System signals in the Setup menu.

Current display reg:

Here is where you select the data register which in Run mode will contain the number of the block shown of the display. The data register is updated automatically when the block is changed.

Note!

This register is used only for reading current text block number- never for selecting. You cannot change textblocks by changing the value from the PLC program.

Commands:

This function is not normally used. For more information refer to the PC software manual.

Country settings

Selecting menu language and character set.



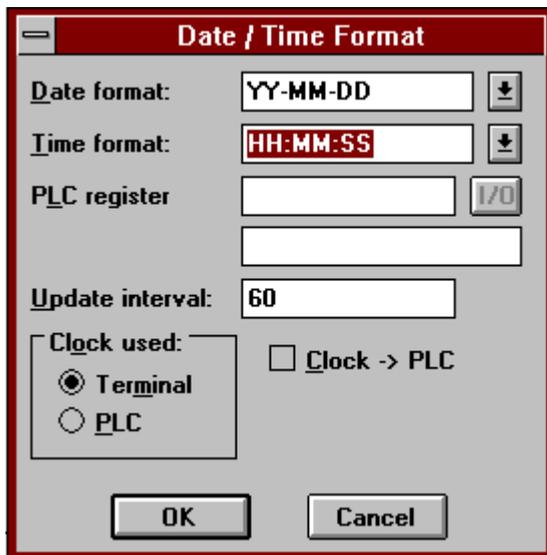
Select Country Settings in the Setup menu. Refer to the PC software manual for further information.

Note!

This command is used only to change the language for system texts. It does **not** offer the choice of language for preprogrammed project.

Date/time-format

Choice of date and time settings.



Select Date/Time Format in the Setup menu

The following characters can be used to set the required date and time format:

D	-Day, numeric.
H	- Hour, numeric.
M	- Minute and month, numeric.
S	- Second, numeric.
Y	- Year, numeric.
- : . / , [Blank]	- Punctuation marks.

Valid formats for date settings are, for example:

Format	Example
YY-MM-DD	95-08-15
YYMMDD	950815
DD.MM.YY	15.08.95
DD/MM-YY	15/08-95

Valid formats for time settings are, for example:

Format	Exempel
HH:MM:SS	15:33:36
HH.MM	15.33

Note!

To set the real-time clock during Run mode you must create a Date/Time object.

Clock used:

Here you select whether the real time clock in the terminal or PLC system shall be used. Switch between the terminal and PLC by using the space bar. The PLC's real time clock is set in the same way as that for the terminal.

Clock→PLC

Here you select whether the real time clock shall be transferred to a PLC register. This provides the possibility of getting a real time clock in those PLC CPU's that lack one.

PLC-register:

The real time clock is transferred to the register in the manner PLC-reg: and the six following. If D8013 is given as the PLC-reg: values for date and time are displayed in binary form according to the table below.

Data register	Presentation
D700	second
D701	minute
D702	hour
D703	day
D704	month
D705	year
D706	day of the week

Update int.

If Clock→PLC is selected this constant defines the update frequency in seconds.

Online changes

Enable possibility for changes during Run mode. For time channels, online changes means that during run mode you can change time settings for a time channel.

Terminal

Terminal options.

Keyboard repeat

You can choose whether you want a function repeated while keeping a key down. Use the space-bar to change between YES and NO.

8.4 Programming

You program the terminal with the PC software installed on a personal computer. The terminal will enter the *Communication with PC software* mode if you keep the [←] [-] keys down continuously during terminal power-up.

8.4.1 Creating a project

A program is created through selecting New from the File menu. Then you make selections according to what the PLC system project will be used for. For more information on this function see the separate PC software manual.

8.4.2 Definition of textblocks

Textblocks consists of a arbitrary number of lines. Lines can be up to 16 characters long. If a block consist of two/three lines or more, use the arrow keys to scroll between lines on the display. An application can consist of up to 999 blocks. The following blocks are reserved for the system blocks as indicated:

0	Main menu
990	<i>Reserved for compatibility with other terminals</i>
991	Time channel editor
992	
|	<i>Reserved for compatibility with other terminals</i>
999	

When you select New in the block list the following menu is displayed.

The screenshot shows a dialog box titled "Block Header" with the following fields and controls:

- Block no.:** Input field containing the number "2".
- Block name:** Empty input field.
- Display signal:** Input field with a small "I/O" button to its right.
- Printer signal:** Input field with a small "I/O" button to its right.
- Completion signal:** Input field with a small "I/O" button to its right.
- Password:** Empty input field.
- Block type:** Radio buttons for "Graphic" and "Text". "Text" is selected.
- Block width:** Radio buttons for "EOL" and "16". "16" is selected.
- Status:** Input field containing the number "0".
- Local Fkeys...:** A button located below the "Block width" section.
- Buttons:** "OK", "Cancel", and "Reset" buttons are located on the right side of the dialog.

Block no:

Type in the appropriate block number. If a textblock already exists for the entered number, the defined values for this block, if any, will be displayed automatically. Use the [↑] and [↓] arrow keys to move between different fields. The text block you want as the main menu and which is displayed immediately after terminal power-up must always be assigned the number 0.

Display signal:

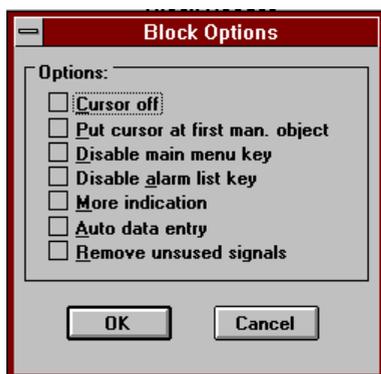
Here you can type in an address for a signal, which when activated, causes the relevant textblock to be displayed. To get block change as quick as possible in Run mode, addresses for display signals should be consecutive.

Block width:

Line length is 16 characters, this cannot be changed for the terminal.

Status:

Defines the character of a display in Run mode. Press the button Status.. to display a list of functions that affect the selection of status words. Mark the current functions.

**Cursor off**

Defines whether the cursor will be displayed in the textblock in Run mode.

Put cursor at first man. obj

Defines whether the cursor is located at the first manoeuvrable object in a textblock instead of at the top left corner.

Auto data entry

Defines whether the cursor is to move automatically to the next manoeuvrable object.

Remove not used signals

Defines whether text lines that contain dynamic objects linked to timers, counters and relays not used in the PLC system are shown on the display. Does not concern data register types D and R.

Press [F2] to edit a textblock. To return to the previous menu press [Esc].

8.4.3 Dynamic objects

Dynamic objects can be found throughout textblocks. To create a dynamic object. Select current object in the toolbox.

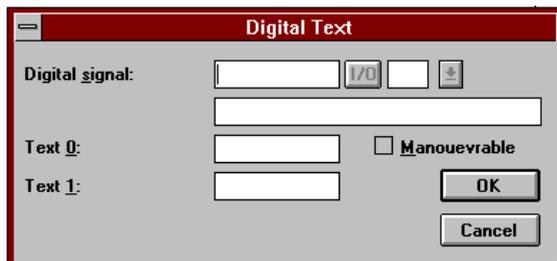


Note!

If the input picture of the object is shown, you can copy the latest configuration of the relevant object type by pressing [Alt][F4]. Ensure that the object can fit onto the line it is written on.

Digital

Digital objects are objects that only have two states, either one (ON) or zero (OFF). They can be linked to the following types of signal: X, Y, M, S, T, C. For timers (T) and Counters (C) we are referring to the output.



Digital signal:

Address for signal or name.

Text 0:

Text displayed when the signal is 0 (max 7 characters).

Text 1:

Text displayed when the signal is 1 (max 7 characters).

Manoeuvrable:

Define whether you want to be able to force the value of the object with the terminal when in Run mode. It can have the value YES or NO. NO is the default value. Use the space-bar to change between YES and NO.

Analog

Analog objects are objects that represent integer values or floating point values. They can be linked to the following types of signal: D, R, T, C. For counters (C) and timers (T), the current values are displayed in Run mode if not PRE is defined.

Note!

If the terminal is used together with an FX system which make use of an EEPROM memory. You set the presets for timers and counters via data registers when in run mode. This is **not** true with FX0.

Analog signal:

Define the address or name of the analog object here. By providing the analog signal with an affix you can present double registers and unsigned values.

Note!

Values displayed as decimals and/or scaling values are stored internally as a floating number accurate to 7 significant digits. To avoid any inaccuracies caused by rounding of the last digit in longer numbers, you must use integer only, which are stored correctly.

The following combinations are possible:

Sign	PLC register type	Range
D100	Single	-32768 – +32768
D100 +	Single	0 – +65535
D100 L	Double	-2147483648 – +2147483648
D100 L+	Double	0 – +4294967295

For timers, counters and high speed counters either the preset or actual value be presented, the possibilities are as follows:

Sign	Presentation
T50	T50 current value
T50 L	T50 and T51 current value
T50 PRE	T50 preset value
T50 LP	T50 and T51 preset value

Position:

Define the number of positions (characters) occupied by an object. Characters such as a minus sign or decimal point must be included, if any. The default value is 5.

Decimals:

Define the number of decimals that should be presented. The default value is 0.

Manoeuvrable:

Define whether you want the operator to be able to change the value of an object using the terminal.

Minimum value:

Define the smallest value that the operator can enter for an object.

Maximum value:

Define the largest value that the operator can enter for an object.

Offset value: & Gain value:

These parameters are used to scale the signal address value in the PLC to a displayed value according to the following equation:

$$\text{DisplayedValue} = \text{Offset} + \text{Gain} * \text{RegisterValue}$$

If a value is changed using the terminal in Run mode, the value is scaled to a signal address value according to the following equation:

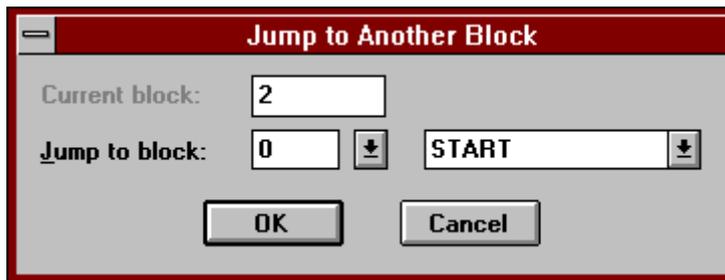
$$\text{RegisterValue} = (\text{DisplayedValue} - \text{Offset})/\text{Gain}$$

Scaling does not affect any max. or min. values defined or the number of decimals presented.

Jump

Jump objects

Jump objects make it possible to build up a menu tree for an application.

**Jump to block:**

Define the number of the text block you want to jump to. If a jump to a non-existing block is generated during Run-mode, a system error will be shown.

Date/Time

Date and time objects fetch data from the terminal's or PLC's real-time clock.



Day of the week

Define whether you want the day of the week displayed. Weekdays occupies 2 positions.

Date

Define whether you want the date displayed. The date normally occupies 8 positions.

Time

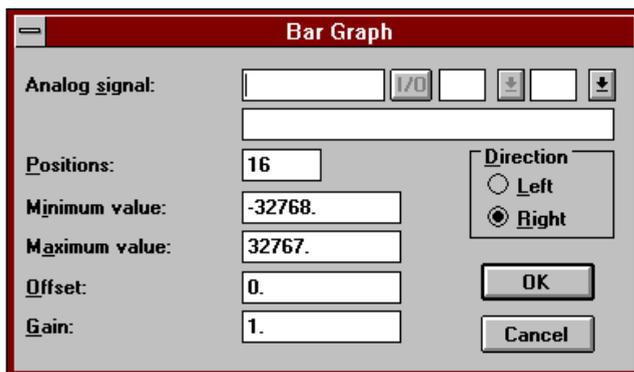
Define whether you want the time displayed. The time normally occupies 8 positions.

Manoeuvrable

Define whether you want to be able to change the value of an object using the terminal in Run mode.

Bar graph

Bar graph objects represent integer or decimal numbers in the shape of a bar graph. As bar graphs are displayed horizontally, the maximum number of positions (characters) will be occupied by the bar graph when it has reached maximum value. Bar graph objects can be assigned the following analog signals: D, R, T, C.



Analog signal:

Address or name for signal.

Position:

Define the number of positions (characters) occupied by the signal. The maximum number of positions is 16.

Direction:

Define whether you want the bar graph displayed to the right or left.

Minimum value:

Define the smallest value shown for the signal.

Maximum value:

Define the largest value shown for the signal.

Offset value: & Gain value:

These parameters are used to scale the signal address value to a displayed value according to the following equation:

$$\text{DisplayedValue} = \text{Offset} + \text{Gain} * \text{RegisterValue}$$

Scaling does not affect any max. or min. values defined.

Multiple choice

A multiple choice object can represent several states. The object is linked to three digital signals that together can represent 8 different states to, one for each status. You can link text of up to seven characters. Digital objects can be assigned the following types of signal: X, Y, M, S, T, C.

Multiple Choice

Digital signal 1: [] [1/0] [] [v]
[]

Digital signal 2: [] [1/0] [] [v]
[]

Digital signal 3: [] [1/0] [] [v]
[]

Text:

0 0 0	[]	<input type="checkbox"/> Man.
0 0 1	[]	<input type="checkbox"/> Man.
0 1 0	[]	<input type="checkbox"/> Man.
0 1 1	[]	<input type="checkbox"/> Man.
1 0 0	[]	<input type="checkbox"/> Man.
1 0 1	[]	<input type="checkbox"/> Man.
1 1 0	[]	<input type="checkbox"/> Man.
1 1 1	[]	<input type="checkbox"/> Man.

OK
Cancel

Signal 1 - Signal 3:

Address or name for signal. It is not necessary to type in 3 signals, if 2 are entered then 4 different statuses are displayed.

Text 000 - Text 111:

The texts that will be displayed for the different statuses.

Status	Signal 1	Signal 2	Signal 3
Text 000	0	0	0
Text 001	0	0	1
Text 010	0	1	0
Text 011	0	1	1
Text 100	1	0	0
Text 101	1	0	1
Text 110	1	1	0
Text 111	1	1	1

Manoeuvrable:

Define whether you want to be able to force the status of an object using the terminal when in Run mode.

Text

Object for handling ASCII strings. It is possible to use a text object to display text stored in the CPU's data registers. The text must be in ASCII format. A text object can be assigned the following signal: D and R.

Analog signal:

Define the register in which the first position is stored.

Position:

Define the number of positions the text will occupy on the terminal display. Each register holds 2 characters (2 positions). The default value is 8 positions which is equivalent to 4 registers. The maximum number of positions is 16.

8.4.4 Definition of time channels

Time channels are used to set and reset digital signals in relation to the real-time clock. When creating your own application projects, the only limitation to the number of time channels is the memory capacity of the terminal.

Select Time channels from the View menu.

Type in the text you want displayed when text block 991 is activated. Press [F4] to edit the time channel or press [Enter] to type in text for the next time channel.

The screenshot shows a window titled "Project:Timechannels" with the following fields and controls:

- Interval text:** A text box containing "DAGTIDER".
- Signal:** A text box containing "X0" and a button labeled "I/O".
- Interval:** A table with 4 rows and 4 columns: "No", "From Day", "To Day", and "From Time" / "To Time".

No	From Day	To Day	From Time	To Time
1	Monday	Friday	0700	1700
2	Saturday	Sunday	1200	1600
3				
4				
- Buttons on the right: Update, Append, Insert, Delete, Exit.
- A list box at the bottom shows "1 DAGTIDER".

The following can be defined for time channels: which signal is activated by the time channel and within which time interval the time channel remains active. You can define 4 different time intervals for each time channel. Each interval is defined according to the format

W W HHMM-HHMM

W means weekday. Weekdays are defined using a number 1-7 (from Monday to Sunday). Alternatively press [F9] to select from a menu. End each format input with [Enter].

8.5 Transferring an application

The Communication mode is used to transfer application projects between the terminal and a personal computer. The terminal will enter the "Communication with PC software" mode if you press the [←] [-] keys down continuously during terminal power-up.

Application transfer can only be carried out if the PC software is installed in the personal computer for programming and documenting the terminal. The PC software is available for use with IBM compatible Personal computers with DOS.

8.6 Run mode

In Run mode you can display machine function status and control a process from the terminal. The terminal will enter Run mode automatically on terminal power-up and text block 0 will be displayed.

The functions of the different objects during Run mode are described below. They do not correspond to the actual menu selection during terminal operation.

Textblock

A textblock consists of text lines of static words and dynamic objects.

```
Heating time 7.3s
```

The dynamic objects show the current status of the signals to which the objects are linked.

Certain dynamic data fields are manoeuvrable, which means that it is possible to change their status and value on-line. To change a manoeuvrable object, use the arrow keys to position the cursor on the required object. To change status of a digital object, press [+] or [-]. Analog and Date/Time objects are changed by positioning the cursor on the required object and then using the [+] or [-] key to increase or decrease the value respectively.

A multichoice object is changed by first using the arrow keys to position the cursor on the required object and then pressing [+] to display a menu of the statuses that can be changed. Move to the appropriate status, press [+] and the 3 digital signals which are linked to the status will be forced.

Time channels

Controlling and changing time channels. To display time channels, you must link system block 991 to a digital signal or jump to block 991. To read or change a time channel value, select the time channel by moving the cursor to the appropriate line. Press [+] and then read and/or change the time interval. However, changes cannot be made to digital signals. To be able to change the value of the time channel in Run mode, the alternative time channels in the dialog Online changes must be marked in the configuration.

8.7 Preprogrammed project

MAC 10/MTA-10

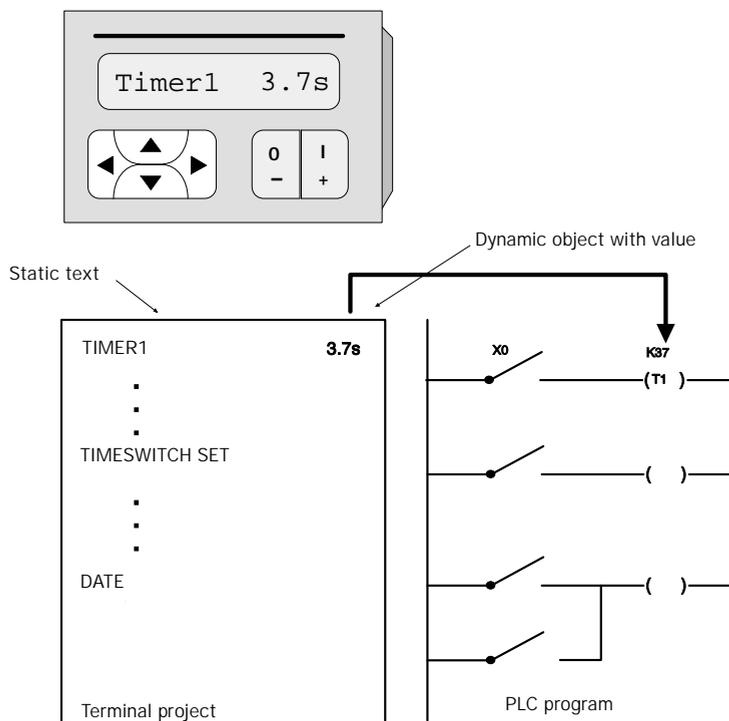
MAC 10/MTA-10 is supplied with a preprogrammed application project which consists of one textblock.

Press the [→] [-] keys down continuously during power-up of the terminal to install the preprogrammed project in the program memory.

The first text displayed is a menu which allows you to choose a language. Move the cursor between the alternative using the keys [↑] and [↓]. Select the desired alternative by pressing [+].

The preprogrammed project includes a textblock. The objects in the textblock are linked to timers, counters, memory cells, data registers and time switches. Since the PLC program handles signals which are linked to objects listed in the textblock, you can use the terminal to change preset values for timers and counters, manoeuvrable digital and analog signals, as well as the time intervals for time switches.

The list below shows how objects are linked to signals:



Object	Signal
Timer 1 #----s	Timer preset value (8 timers), T1
Timer 2 #----s	T2
Timer 3 #----s	T3
Timer 4 #----s	T4
Timer 5 #----s	T5
Timer 6 #----s	T6
Tidrelä7 #----s	T7
Timer 8 #----s	T8
Counter 1 #---	Counter current value (4 counters), C1
Counter 1 #---	C2
Counter 1 #---	C3

Object	Signal
Preset R3 #----	Counter preset, C3
Counter 4 #----	C4
Preset R4 #----	Counter preset, C4
Relay 1 #---	M relay ON/OFF (4 relays), M1
Relay 2 #---	M2
Relay 3 #---	M3
Relay 4 #---	M4
TimeSwitch 1 #---	Time channel ON/OFF indication/forcing (4 time channels), M5
TimeSwitch 2 #---	M6
TimeSwitch 3 #---	M7
TimeSwitch 4 #---	M8
# TimeSwitch set	Jump to time channels block 991
Date #-----	Date in national format
Time #-----	Time in national format
Register1 #----	Data register (2 register), D1
Register2 #---	D2

Only those timers, counters and relays which are used in the PLC program are displayed on the terminal; if there is no program in the PLC system then "TimeSwitch set" in the first line displayed. The character "#-----" indicates a dynamic object. The number of characters including # indicates the number of positions occupied by a signal's value on the display. The number of positions are defined when you define the object. # also indicates jump objects to other textblock.

Note!

Time intervals set for time channels are erased if you change the language on the pre-programmed project in the terminal.

8.8 PLC program transfer

MAC 10/MTA-10

MAC 10/MTA-10 allows storage of a PLC-program of 2000 steps (4000 bytes) in the terminal EEPROM.

This feature can be used if the PLC has to be exchanged. The new PLC can easily with the terminal be loaded with the PLC program again. This could also be a convenient method to update an installation, only by sending a new terminal with an updated application for both PLC and the terminal.

The PLC program must be written in MELSEC MEDOC to allow transfer. See "Terminal - SC-06N - PC" drawing in Appendix for drawings.

Note!

MELSEC MEDOC FX0 does not have this function.

From MEDOC to the terminal

MEDOC

Select GPP in the Transfer menu. Then select MEDOC→GP.

MAC 10

Press the [↓] [-] keys down continuously during power-up.

Press [↓].

PLC/MEDOC → Term is now displayed. Press [+] to begin the transfer.

From the terminal to MEDOC

MEDOC

Select GPP in the Transfer menu. Then select MEDOC→GP.

MAC 10

Press the [↓] [-] keys down continuously during power-up.

Term→ PLC/MEDOC is now displayed.

Press [+] to begin the transfer.

From the terminal to PLC

PLC

Ensure the PLC is in stop mode.

MAC 10

Press the [↓] [-] keys down continuously during power-up.

Term → PLC/MEDOC is now displayed.

Press [+] to begin the transfer.

From PLC to the terminal

MAC 10

Press the [↓] [-] keys down continuously during power-up.

Press [↓] again.

PLC/MEDOC → Term is now displayed. Press [+] key to begin the transfer.

9 Appendix

9.1 Modes

The terminal modes:

Select preprogrammed project
 Communication with PC software
 Run mode
 Configuration mode
 PLC transfer

See section Mode selection in the chapter Reference guide for mode selection.

9.2 Dynamic object

The following objects can be used in blocks:

Digital	Digital object (2 states)
Analog	Analog object as value
Bar Graph	Proportional fillning of analog object
Multiple choice	Digital object (8 states)
Text	Text strings from PLC
Jump	Jump to block
Date/Time	Date and /or time

9.3 System blocks

Certain blocks are reserved for special purposes:

0	Main menu
990	<i>Reserved for compatibility with other terminals</i>
991	Time channels
992	
|	<i>Reserved for compatibility with other terminals</i>
999	

9.4 Keys

Certain keys have different functions in Run mode. The following keys have the functions listed:

	Set manoeuvrable digital object (ON). Increase value of manoeuvrable analog object. Execute jump. Select/execute choice from a multichoice object.
	Reset manoeuvrable digital object (OFF). Decrease value of manoeuvrable analog object.
	Move up one line. If the first line of time channel settings: return to previous level.
	Move to next field.
	Move to previous field.
	Move down one line.

9.5 Default set-up

The terminal is delivered with the following settings:

Language	English (British or American)	
Character set	Swedish	
Date/Time format	Date	YY - MM - DD
	Time	HH : MM : SS
On-line changes	Time channels:	Yes

9.6 Data

	MAC 10	MAC 12
Front panel	Width 96 x hight 72 x depth 3 mm	
Mounting depth	37 mm	41 mm
Mounting holes	92 ± 1 x 68 ± 1 mm	
Front panel seal	IP 65	
Rear panel seal	IP 20	
Front panel materiall	1,5 mm blac anodized aluminium and membrane keyboard. Overlay film of posyester with backside printing.	
Container material	Black varnished steel.	
Weight	230 g	
PLC system connection	8-pol Mini-Din contact	
Cable to PLC system	4-pair, shielded, pair twisted	
Display	LCD (Liquid crystal display) Supertwist 1 line x 16 character 8 mm character height. Contrast setting adjustable with a encased potentiometer.	LCD (Liquid crystal display) Supertwist 2 row x 16 character 5 mm character height with backlight. Contrast setting adjustable with a encased potentiometer.
Real time clock	Min 10 year lifetime	
Supply voltage	+5V from PLC system CPU port via communication cable.	
Internal power	+5V±5%	
Power consumption	60 mA	150 mA
Ambient operating temperature	0° till +50°C	
Storage temperature	-20° till +6+°C	
Humidity	Max 90% utan kondensation	
Noise test	Noise tested according to : IEC 801-2 (4kV contact, 8kV Air discharge), IEC 801-3 (15V/m), IEC 801-4 Nivå 4, IEC 801-5 med 24 V, SS 4361503.	
EMC-tests	Beijer Electronics AB confirm that the terminals conforms with the essential protection requirements in article four of the directive 89/336/EEC.	

9.7 Character tables

Higher Lower 4bit 4bit	0000	0010	0011	0100	0101	0110	0111	1010	1011	1100	1101	1110	1111
xxxx0000	CG RAM (1)		0	1	2	3	4	5	6	7	8	9	A
xxxx0001	(2)	!	1	2	3	4	5	6	7	8	9	0	1
xxxx0010	(3)	"	2	3	4	5	6	7	8	9	0	1	2
xxxx0011	(4)	#	3	4	5	6	7	8	9	0	1	2	3
xxxx0100	(5)	\$	4	5	6	7	8	9	0	1	2	3	4
xxxx0101	(6)	%	5	6	7	8	9	0	1	2	3	4	5
xxxx0110	(7)	&	6	7	8	9	0	1	2	3	4	5	6
xxxx0111	(8)	'	7	8	9	0	1	2	3	4	5	6	7
xxxx1000	(1)	(	8	9	0	1	2	3	4	5	6	7	8
xxxx1001	(2)	)	9	0	1	2	3	4	5	6	7	8	9
xxxx1010	(3)	*	0	1	2	3	4	5	6	7	8	9	0
xxxx1011	(4)	+	1	2	3	4	5	6	7	8	9	0	1
xxxx1100	(5)	,	2	3	4	5	6	7	8	9	0	1	2
xxxx1101	(6)	-	3	4	5	6	7	8	9	0	1	2	3
xxxx1110	(7)	.	4	5	6	7	8	9	0	1	2	3	4
xxxx1111	(8)	/	5	6	7	8	9	0	1	2	3	4	5

				D7	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	
				D6	0	0	0	0	1	1	1	1	0	0	0	0	1	1	1	
				D5	0	0	1	1	0	0	1	1	0	0	1	1	0	0	1	
				D4	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	
D3	D2	D1	D0		0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0	0	0	0	0			SP	0	0	P	`	PE	Σ		"	A	0	Δ	Δ	Δ
0	0	0	1	1		DC1	!	1	A	0	a	a	°	0	i	±	A	N	Δ	N
0	0	1	0	2		DC2	"	2	B	R	b	r	f	=	0	?	A	0	Δ	Δ
0	0	1	1	3			#	3	C	S	c	s	t	x	E	°	A	0	Δ	Δ
0	1	0	0	4		DC4	\$	4	D	T	d	t	L	+	0	'	A	0	Δ	Δ
0	1	0	1	5		DC5	%	5	E	U	e	u	w	°	°	°	A	0	Δ	Δ
0	1	1	0	6		DC6	&	6	F	U	f	u	r	°	°	°	A	0	Δ	Δ
0	1	1	1	7		DC7	'	7	G	U	u	w	°	E	S	-	°	x	°	°
1	0	0	0	8	BS	CT0	(	8	H	X	h	x	e	≤	'	.	e	°	e	°
1	0	0	1	9	HT	CT1	)	9	I	Y	i	y	h	≤	°	°	e	°	e	°
1	0	1	0	A	LF		*	:	J	Z	j	z	°	°	°	°	e	°	e	°
1	0	1	1	B		ESC	+	;	K	L	k	l	°	°	°	°	e	°	e	°
1	1	0	0	C	FF		,	<	L	\	l	l	π	°	°	°	w	i	U	i
1	1	0	1	D	CR		-	=	M	I	m	°	°	°	°	°	w	i	Y	i
1	1	1	0	E	CLR		.	>	N	^	n	°	°	°	°	°	■	i	D	T
1	1	1	1	F			/	?	0	_	o	°	°	°	°	°	■	i	P	i

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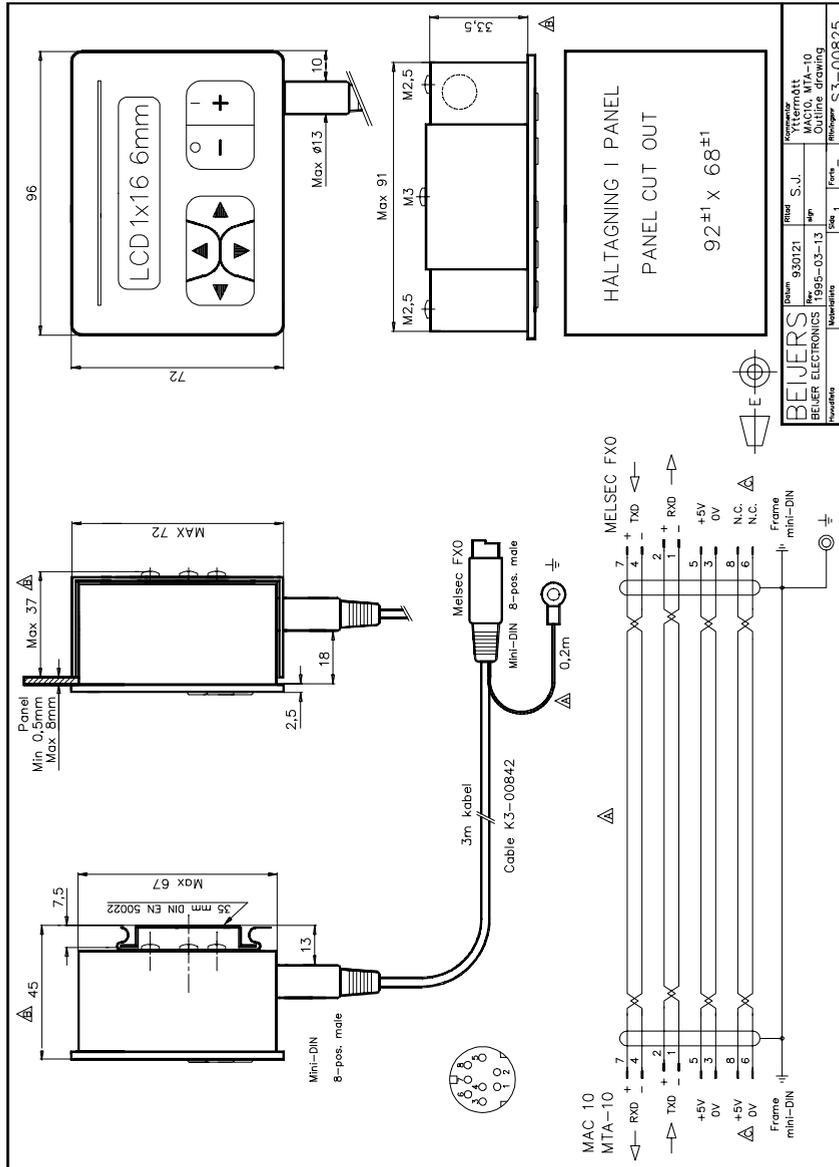
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10 Appendix for drawings

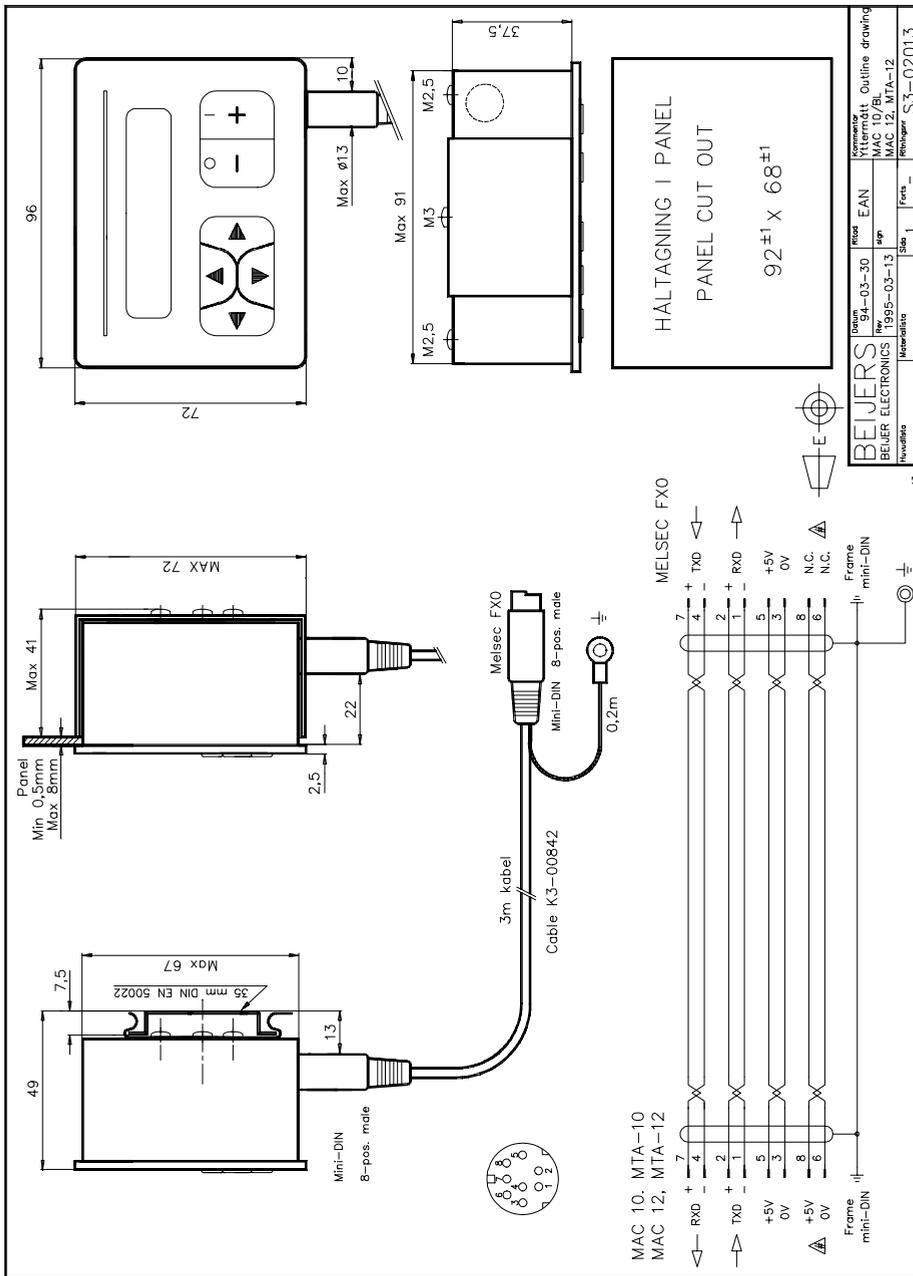
Dimensioner MAC 10/MTA-10

Dimensioner MAC 10



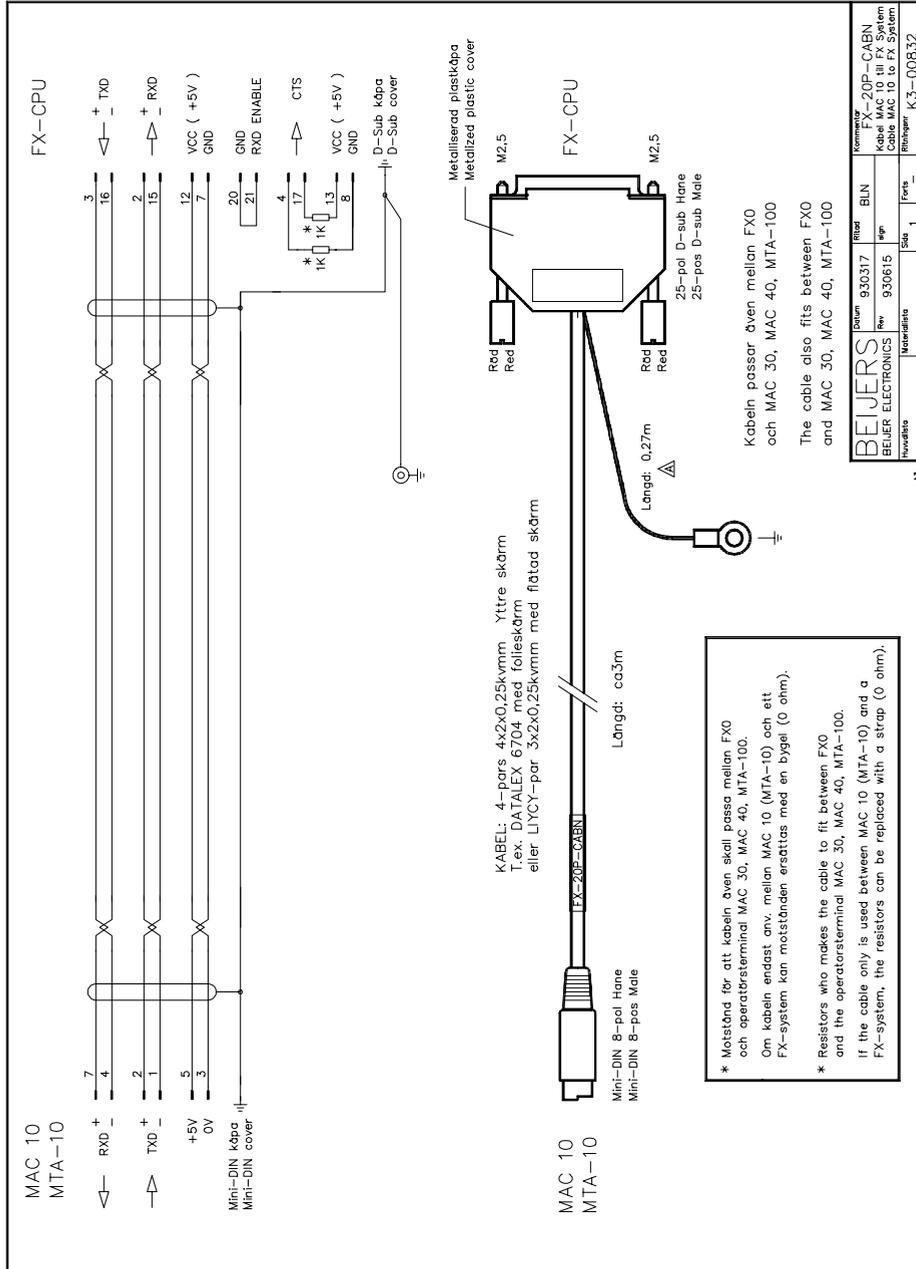
Dimensions MAC 12/MTA-12

Dimensioner MAC 12



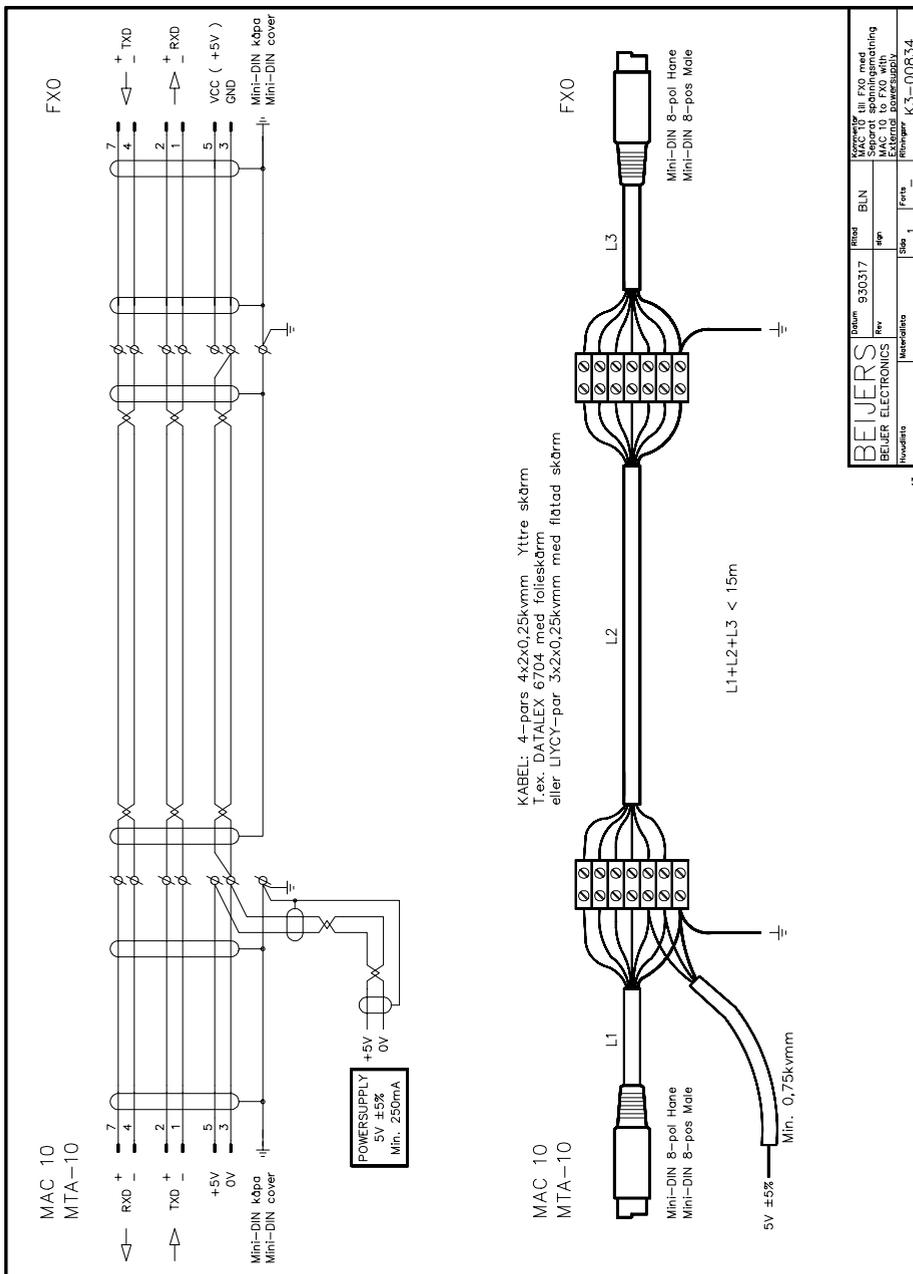
Cable from terminal to FX

Kabel från terminal till FX



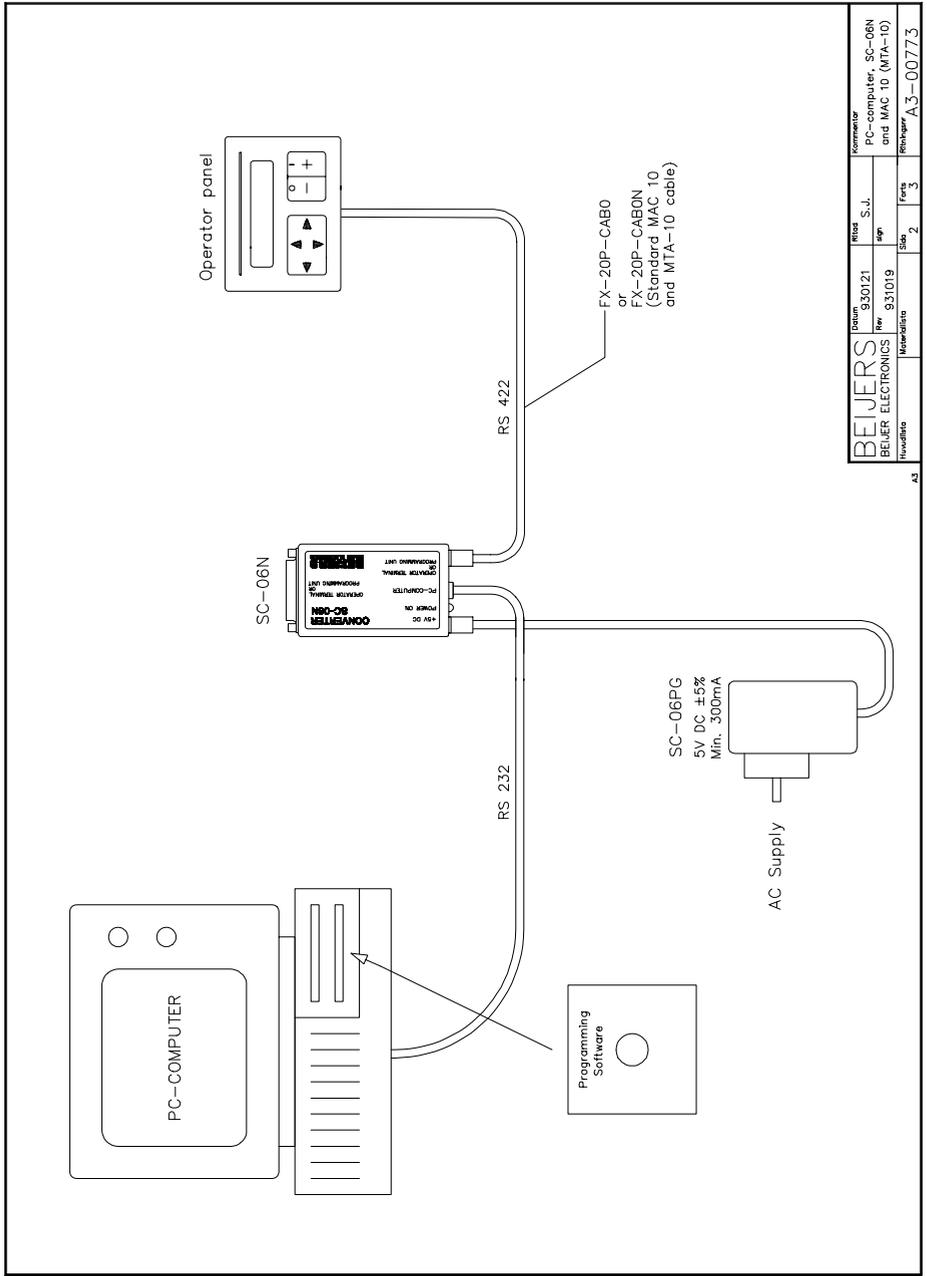
Cable from the terminalen to FX0/FXON with external supply voltage

Kabel från terminalen till FX0/FXON med extern spänningsmatning



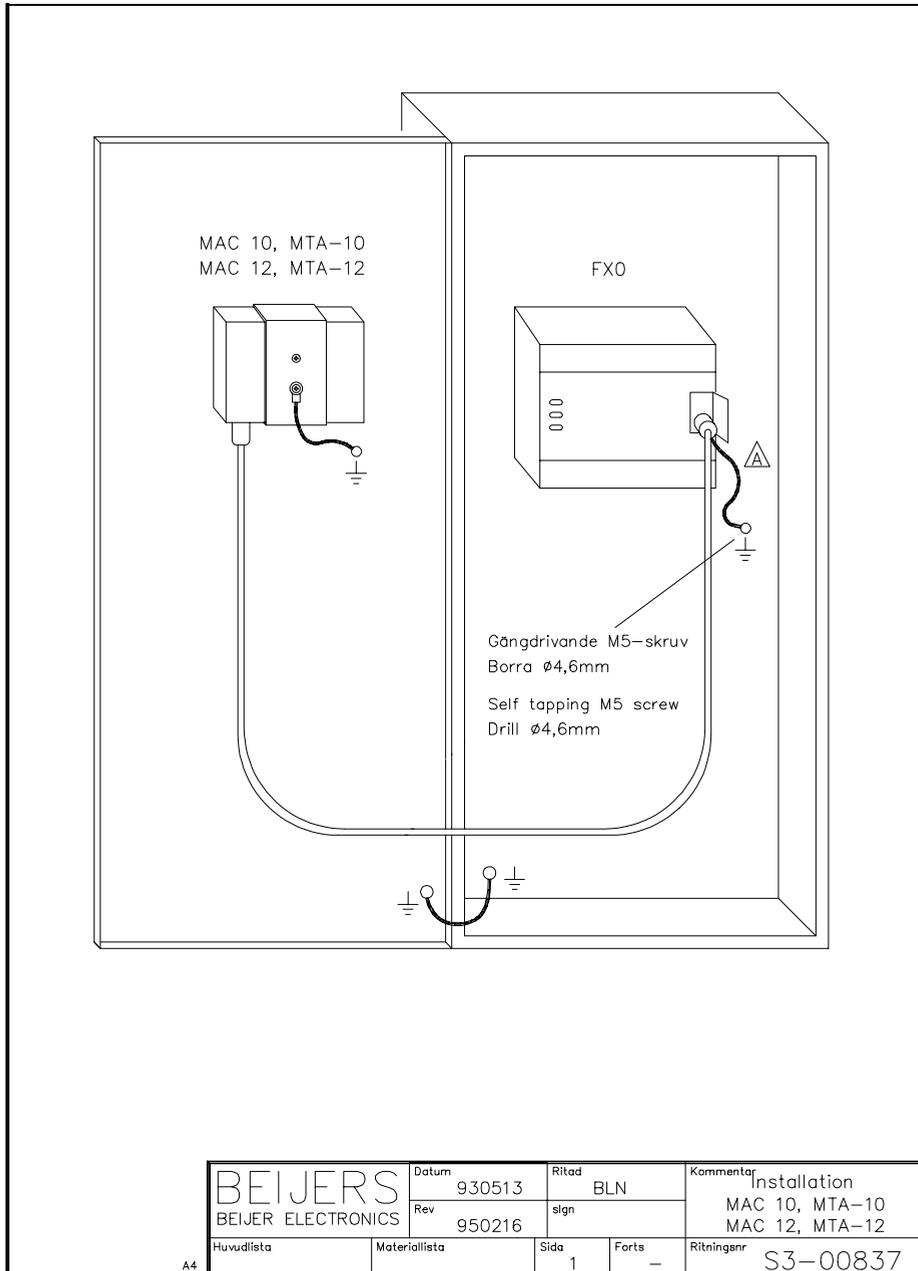
Terminal - SC-06 - PC

Terminal - SC-06 - Persondator



Installation

Installation



CR01 - F-CPU to the terminal (1200m)

CR01 - F-CPU till terminal (1200m)

