

RS-232 and RS-485
DISPLAYS OPERATION
MANUAL

DT-105X, DT-106X, DT-110X,
DT-111X and DT-203X



Index

<u>1.-INTRODUCTION</u>	1-1
<u>2.-GENERAL SPECIFICATIONS</u>	2-1
2.1 Electrical specifications DT-105X.....	2-1
2.2 Electrical specifications DT-106X.....	2-2
2.3 Electrical specifications DT-110X.....	2-3
2.4 Electrical specifications DT-111X.....	2-4
2.5 Electrical specifications DT-203X.....	2-5
2.6 Specifications humidity and temperature sensor (Option)	2-6
<u>3.-INSTALATION</u>	3-1
3.1 Power supply.....	3-2
3.2 Series line connections.....	3-3
3.2.1 Connection diagram between a DT-105/106/110/111/203X display and PC computer using RS-232.....	3-5
3.2.2 RS-485 connection diagram between DT-105/106/110/111/203X and PC computer and RS-232/RS485 converter Afeisa.....	3-6
3.2.3 RS-485 connection between 3 DT-105/106/110/111/203X displays and PC computer.....	3-7
3.2.4 RS-485 connection between DT-105/106/110/111/203X displays, a computer and a CV-485 converter of EKODAT.....	3-8
3.2.5 RS-422 connection between DT-105/106/110/111/203X displays, and an SCB41 communication kit of OMRON.....	3-10
3.2.6 RS-422 connection between DT-105/106/110/111/203X displays, and an LK202 communication kit of OMRON.....	3-11
3.2.7 RS-232 connection between DT-105/106/110/111/203X displays, and an OMRON PLC.....	3-12
3.2.8 RS-485 connection between DT-105/106/110/111/203X displays and a Siemens PLC S7-200	3-13
<u>4.-WORKING ORDER</u>	4-1
4.1 Initial Reset.....	4-1
4.2 Message programming	4-1
4.3 Set parameters.....	4-2
4.3.1 Modify parameters.....	4-2
4.3.2 Exit modify parameters.....	4-3
4.3.3 Meaning of each parameter.....	4-3
<u>5.-PROTOCOLS</u>	5-1
5.1 Lartet protocol.....	5-2
5.1.1 Start block.....	5-3
5.1.2 Address.....	5-3
5.1.3 Number of bytes.....	5-3
5.1.4 Data.....	5-3
5.1.4.1 Displaying a message (One line display).....	5-4
5.1.4.2 Displaying a message (More than one line).....	5-5
5.1.4.3 Updating Date and Hour of Clock and calendar.....	5-6
5.1.4.4 Set CONTINUOUS mode.....	5-7
5.1.5 End of data.....	5-8
5.1.6 CRC.....	5-8
5.1.7 End of block.....	5-8
5.1.8 Display acknowledge.....	5-8

Index

5.2 ModBus protocol	5-9
5.2.1 Display address.....	5-10
5.2.2 ModBus code: write n words.....	5-10
5.2.3 Control.....	5-10
5.2.4 First.....	5-11
5.2.5 Number of words.....	5-11
5.2.6 Number of characters.....	5-11
5.2.7 Data.....	5-12
5.2.8 CRC.....	5-12
5.2.9 Structure of data block.....	5-13
5.2.9.1 Direct control.....	5-13
5.2.9.2 Control by code.....	5-14
5.2.10 Acknowledge block.....	5-16
5.3 Omron protocol	5-17
5.3.1 Set a message without variables.....	5-18
5.3.2 Reset a message without variables.....	5-18
5.3.3 Set a message with variables.....	5-19
5.3.4 Reset a message with variables.....	5-19
5.3.5 Reset all messages.....	5-19
5.3.6 Data variables.....	5-20
5.4 ASCII protocol.....	5-22
5.4.1 Acknowledge block.....	5-23
5.5 S7-200 protocol	5-24
5.5.1 Display messages without variables.....	5-25
5.5.2 Reset messages without variables.....	5-25
5.5.3 Display message with variables.....	5-25
5.5.4 Reset messages with variables.....	5-26
5.5.5 Reset all the messages.....	5-26
5.5.6 Variable data.....	5-27
5.5.7 Examples S7-200	5-28

DECLARATION OF CONFORMITY

1. Introduction.

The message displays of **DT-105X, DT-106X, DT-110X, DT-111X and DT-203X** series are industrial displays with **RS-232 and RS-485** serial interface, which can be configured to work with several protocols..

The serial interface, the parameters and the communication protocol can be selected by two push buttons with a system code easy to program.

The display working order is basically based on a microprocessor and on technically advanced control circuits.

Its main characteristic is the size of the characters.

30mm. height for **DT-203**, which allows reading up to 15 meters

50mm. height for **DT-105 and DT-106**, which allows reading up to 25 meters.

100mm. height for **DT-110 and DT-111**, which allows reading up to 50 meters.

They are manufactured with one or two display sides, which provides several possibilities and solutions when it has to be installed.

They can be set up on a surface, whether they are fixed to a wall or a partition, or they can be left hanging from the lateral supports.

There is a wide range of applications for these displays, from industrial applications, such as warning breakdowns or displaying production information, to common advertisements.

*** Internal communication notices aimed at staff.**

"Mr ... phone to switchboard", "Meeting at 11:00", " Welcome Mr Smith from ACME", etc.

*** Production control of machines or installation, etc.**

"Production=1200 P/H", "Amount of manufactured pieces 14.327"

*** Breakdowns**

"Error STATION 5", "Machine 2, out of order", etc.

*** Security alarm**

"Fire in zone 3", "Lights off at 18:30", etc.

*** Advertisement**

"Washing powder JIK 2\$", "Women's clothes first floor, 1^a", etc.

There are also versions of those displays that can be controlled by the PLC's digital outputs. These versions are DT-105P, DT-106P, DT-110P, DT-111P and DT-203P, which aren't explained in this manual.

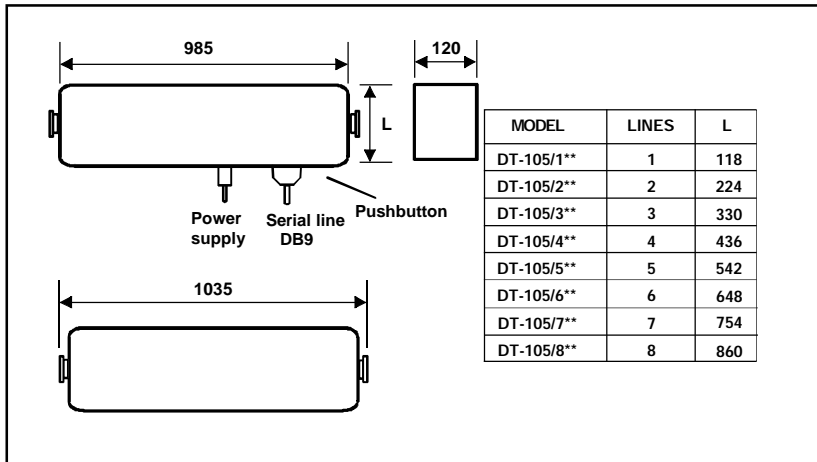
For programming initial texts the TED program is available . which works in PC under MS-DOS and Windows.

This manual describes the technical characteristics and the instructions for the correct use of the displays. We recommend you read it before using a display.

2. General specifications.

2.1 Electrical specifications of DT-105X displays.

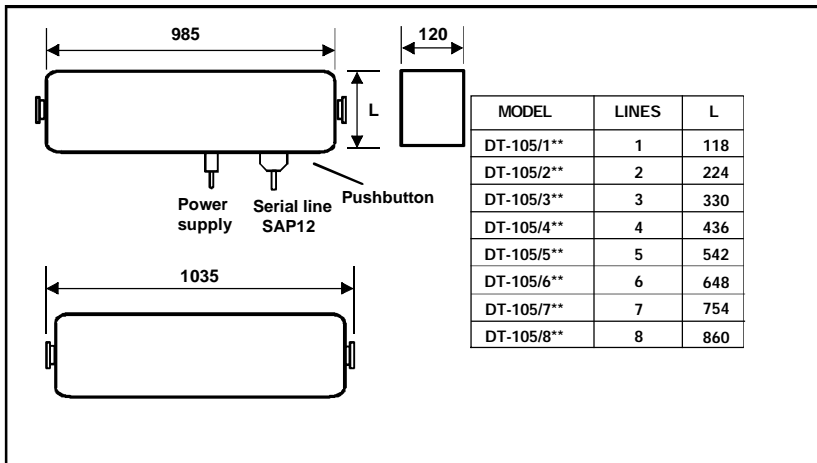
Power supply.....	230VAC ±10% 50/60Hz.
Consumption.....	1 Side = (5 + (Nx20)) VA.
.....	2 Side = (5 + (Nx20x2)) VA.
.....	N=N° of lines.
Display.....	LED. Matrix points by 7x5 of 50mm. in height.
.....	Readable up to 25 meters.
Initial message memory.....	EEPROM.
Watch calendar.....	Second / Minute / Hour / Day / Month / Year.
Environmental conditions.....	Operating temperature: 0 to 50°C.
.....	Storage temperature: -10°C to 60°C.
.....	Humidity: 5-95% without condensation.
.....	Maximum environmental lighting: 1000 lux.
.....	Protection IP 41. Indoor use only.
RS232/RS485 port series.....	For recording the initial messages in EEPROM
.....	and activating messages from the control series device.



2.1 DT-105 display dimensions

2.2 Electrical specifications of DT-106X displays.

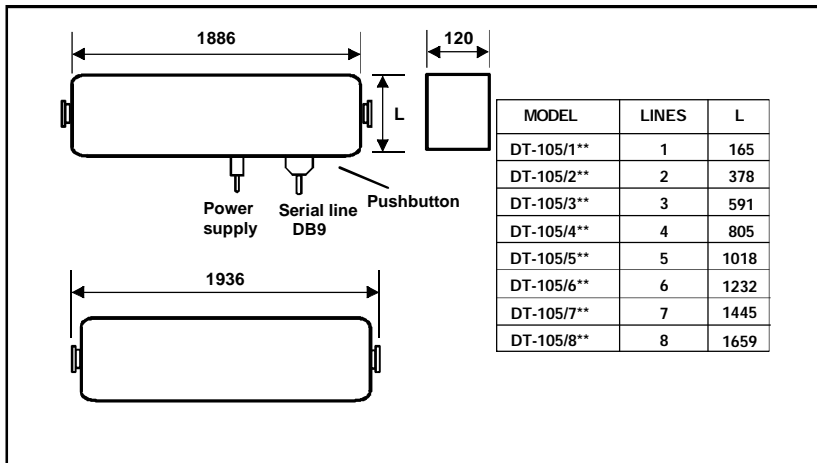
Power supply	230VAC \pm 10% 50/60Hz.
Consumption	1 Side = (5 + (Nx20)) VA.
.....	2 Side = (5 + (Nx20x2)) VA.
.....	N=N° of lines.
Display	LED. Matrix points by 7x5 of 50mm. in height.
.....	Readable up to 25 meters.
Initial message memory	EEPROM.
Watch calendar	Second / Minute / Hour / Day / Month / Year.
Environmental conditions	Operating temperature: 0 to 50°C.
.....	Storage temperature: -10°C to 60°C.
.....	Humidity: 5-95% without condensation.
.....	Protection IP 54. Outdoor use.
RS232/RS485 port series	For recording the initial messages in EEPROM
.....	and activating messages from the control series device.
.....	



2.2 DT-106 display dimension

2.3 Electrical specifications of DT-110X displays.

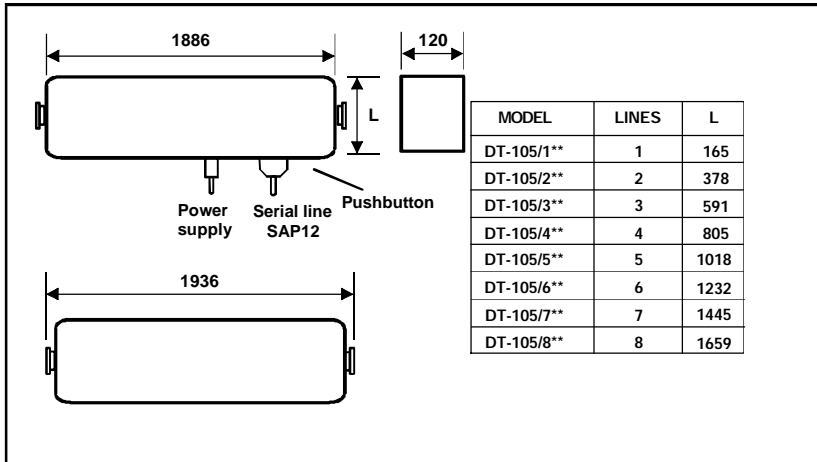
Power supply	230VAC \pm 10% 50/60Hz.
Consumption	1 Side = (5 + (Nx20)) VA.
.....	2 Side = (5 + (Nx20x2)) VA.
.....	N=N° of lines.
Display	LED. Matrix points by 7x5 of 100mm. in height.
.....	Readable up to 50 meters.
Initial message memory	EEPROM.
Watch calendar	Second / Minute / Hour / Day / Month / Year.
Environmental conditions	Operating temperature: 0 to 50°C.
.....	Storage temperature: -10°C to 60°C.
.....	Humidity: 5-95% without condensation.
.....	Maximum environmental lighting: 1000 lux.
.....	Protection IP 41. Indoor use only.
RS232/RS485 port series	For recording the initial messages in EEPROM
.....	and activating messages from the control se-
.....	ries device.



2.3 DT-110 display dimensions

2.4 Electrical specifications of DT-111X displays.

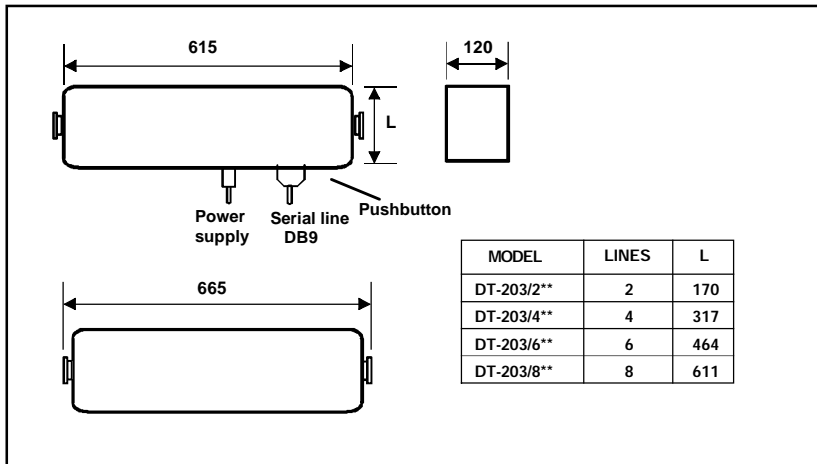
Power supply	230VAC \pm 10% 50/60Hz.
Consumption	1 Side = (5 + (Nx20)) VA.
.....	2 Side = (5 + (Nx20x2)) VA.
.....	N=N° of lines.
Display	LED. Matrix points by 7x5 of 100mm. in height.
.....	Readable up to 50 meters.
Initial message memory	EEPROM.
Watch calendar	Second / Minute / Hour / Day / Month / Year.
Environmental conditions	Operating temperature: 0 to 50°C.
.....	Storage temperature: -10°C to 60°C.
.....	Humidity: 5-95% without condensation.
.....	Protection IP 54. Outdoor use.
RS232/RS485 port series	For recording the initial messages in EEPROM
.....	and activating messages from the control se-
.....	ries device.



2.4 DT-111 display dimensions

2.5 Electrical specifications of DT-203X displays.

Power supply	230VAC \pm 10% 50/60Hz.
Consumption	1 Side = (5 + (Nx20)) VA.
.....	2 Side = (5 + (Nx20x2)) VA.
.....	N=N° of lines.
Display	LED. Matrix points by 7x5 of 30mm. in height. Readable up to 15 meters.
Initial message memory	EEPROM.
Watch calendar	Second / Minute / Hour / Day / Month / Year.
Environmental conditions	Operating temperature: 0 to 50°C. Storage temperature: -10°C to 60°C. Humidity: 5-95% without condensation. Maximum environmental lighting: 1000 lux. Protection IP 41. Indoor use only.
RS232/RS485 port series	For recording the initial messages in EEPROM and activating messages from the control series device.



2.5 DT-203 display dimensions

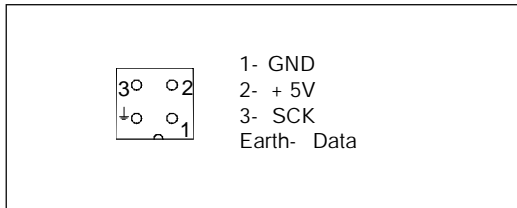
2.6 Specifications humidity and temperature sensor (OPTION).

Relative humidity

Resolution Typical 0,03%
Accuracy $\pm 3,5\%$ between 30% and 70%
Response time 4s.

Temperature

Resolution..... Typical 0,01 °C
Accuracy $\pm 0,5^{\circ}\text{C}$ at 25°C
Response time..... 20 s
Range From -40°C to +123,8°C



2.6.1 Relative humidity and temperature sensor socket.

3. Installation.

The installation of DT-105, DT-106, DT-110, DT-111 and DT-203 displays is not really complicated, but there are some considerations to take into account.

They must neither be fixed in places close to vibration nor in places where the limits described in the general specifications of temperature and humidity are exceeded.

DT-105, DT-110 and DT-203 displays have a IP-41 protection, which means that they are protected from foreign objects the penetration of weird solid items of more than 1mm diameter and from rain falling vertically.

DT-106, DT-111 displays have a IP-54 protection, which means that it is protected againts dirt and from rainfall from any angle.

DT-105, DT-110 and DT-203 displays must not be installed in places where the lighting level is higher than 1000 lux. They must be protected from direct sunlight, which is detrimental to their visibility.

DT-106 and DT-111 displays can be installed outside without problems of visibility.

They must neither be installed close to high voltage electrical conduction cables nor to high voltage lines.

They must stay away from:

High frequency generators, which are frequent in soldering equipment.
U/F converters for motors.

Although the display is removed from noise, prevent it from being close to the conductors or the supply source.

Applying these rules does not requires any additional effort for users. It is necessary just to take into consideration these few precautions before installing the display.

3.1 Power supply.

Power supply must be **230VAC ± 10%, 50/60Hz**.

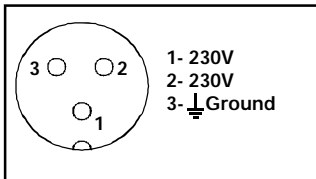
Current consumed by the different types:

DT-105 and DT-106		
	1 Side	2 Side
1 line	0,1A	0,2A
2 lines	0,2A	0,4A
3 lines	0,3A	0,6A
4 lines	0,4A	0,8A
5 lines	0,5A	1A
6 lines	0,6A	1,2A
7 lines	0,7A	1,4A
8 lines	0,8A	1,6A

DT-110 and DT-111		
	1 Side	2 Side
1 line	0,5A	0,9A
2 lines	0,9A	1,7A
3 lines	1,3A	2,5A
4 lines	1,7A	3,3A
5 lines	2,1A	4,1A
6 lines	2,5A	4,9A
7 lines	2,9A	5,7A
8 lines	3,3A	6,5A

DT-203		
	1 Side	2 Sides
2 lines	0,15A	0,25A
4 lines	0,25A	0,45A
6 lines	0,35A	0,65A
8 lines	0,45A	0,85A

Although the display has its own internal protection system, the user should install a fuse or external automatic switch for protection on the power supply cable, which must have a suitable range.



3.1 Power supply 230VAC

The cross-section of the power supply conductors is in line with the consumption. The earth conductor will be a minimum 1,5 mm².

Although the displays are specially made with high level electric noise, when the power supply line is liable to be really noisy, it is advisable to set a transformer and/or a external network filter between the power supply line and the display.

The supply connector is a three-contact type and is located at the bottom of the unit. The connection must be made according to figure 3.1

3.2. Series line connections.

In DT-105X, DT-106X, DT-110X, DT-111X and DT-203X displays, series line has a double function.

1) To transfer texts into the display using a PC and TED program.

The TED program is the tool you need to edit, save and transfer the messages. The TED program sets the computer serial port with these parameters:

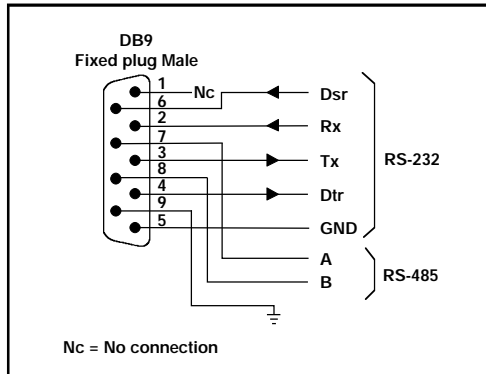
Baud rate: 9600 Parity: Even N° of bits: 8 Stop bits: 2

2) Communication with serial RS232/RS485 units using built-in protocols.
See chapter 4.

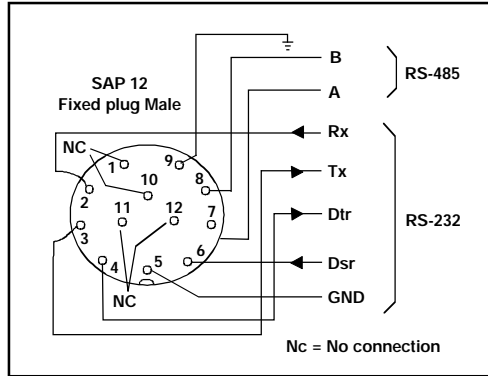
All displays DT105/106/110/111/203/X may use RS232 and RS485 serial lines. Both use the same connector located at the bottom of display.

The DT-105X, DT-110X and DT-203X displays use DB9 connector. See 3.2.a

The DT-106X and DT-111X displays use SAP 12 connector. See 3.2.b.



3.2a Serial line connector DT-105X, DT-110X and DT-203X displays.



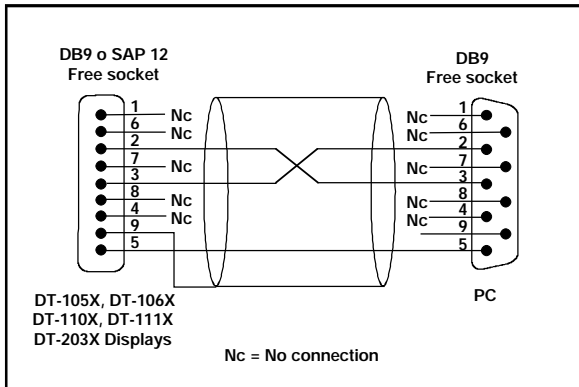
3.2b. Serial line connector DT-106X and DT-111X displays.

3.2.1 Diagram of the connection between a DT-105X, DT-106X, DT-110X, DT-111X and DT-203X display and PC computer using RS-232.

Using an RS-232 serial line, the total length must not be longer than **5m**.

It is important to use shielded cable and to connect the shield to pin 9 of the DB9 connector (in DT-105X, DT-110X and DT-203X displays) or to SAP 12 connector (in DT-106X and DT-111X displays)of the display connector.

The transmission line must be placed away from high power lines.



3.2.1 Connection diagram between a DT-105X, DT-106X, DT-110X, DT-111X and DT-203X displays, with PC using RS-232.

The connector type (plug or socket) refers to type of cable connector.

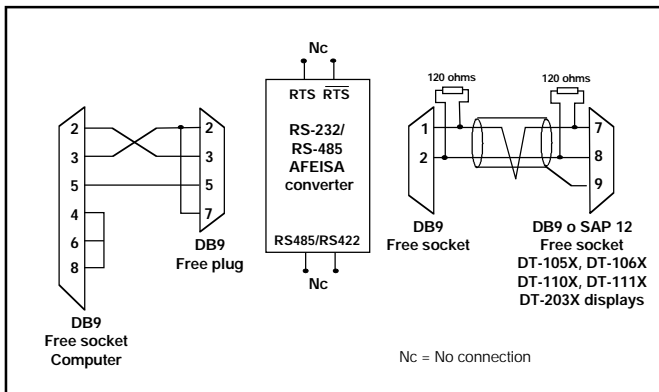
3.2.2 RS-485 Connection diagram between a DT-105X, DT-106X, DT-110X, DT-111X and DT-203X display, a PC and RS-232/422/485 Afeisa converter.

Using an RS-485 serial line, the total length must not be longer than **1000m** without amplifiers.

Is important to use twisted and shielded cable and to connect the shield to pin 9 of the DB9 or SAP 12 connector (depending on the display version).
The transmission line must be placed away from high power lines.
Branches from the network to the displays must be as short as possible.

At both ends of transmission line there must be place a termination resistor of 120 ohm.

In the connector there is enough place to set the resistance together with the connection.



3.2.2 Connection diagram between a DT-105X, DT-106X, DT-110X, DT-111X and DT-203X display, a PC with RS-232/422/485 Afeisa converter.

The connector type (plug or socket) refers to the type of cable connector.

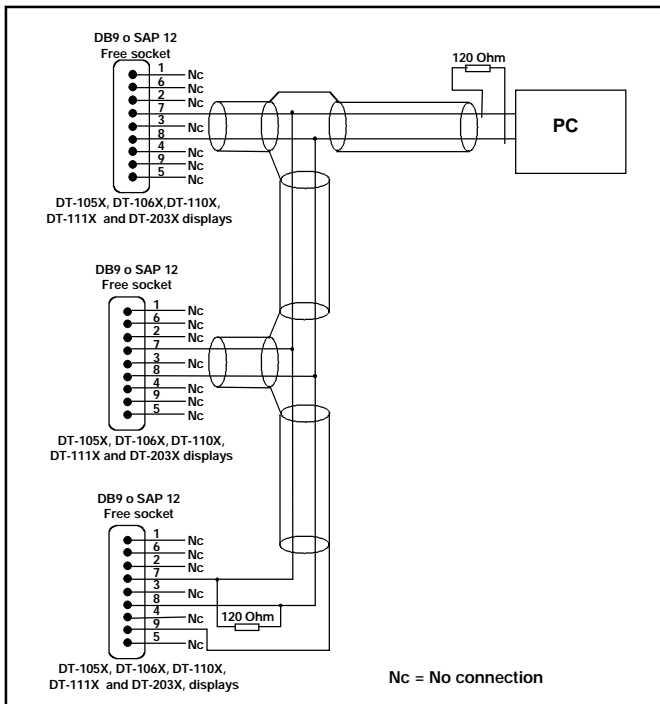
3.2.3 RS-485 Connection diagram between 3 DT-105X, DT-106X, DT110X, DT111X and DT-203X displays , and PC.

Using an RS-485 serial line, the total length must not be longer than **1000m** without amplifiers.

Is important to use twisted and shielded cable and to connect the shield to pin 9 of conector DB9 or SAP 12 (depending on the display version).

The transmission line must be placed away from high power lines.

At both ends of transmission line there must be place a termination resistor of 120 ohm.

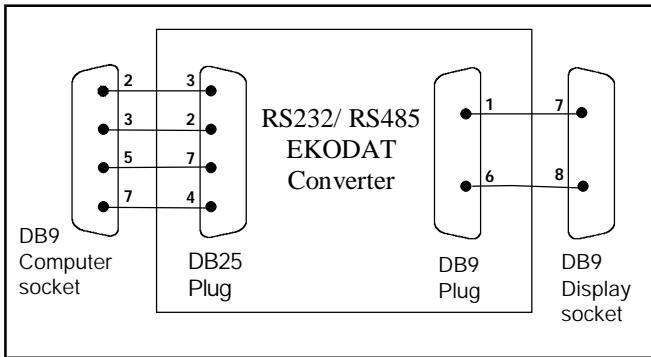


3.2.4 RS-485 Connection between DT-105X, DT-106X, Dt-110X, DT-111X or DT-203X, a PC and a RS-232 to RS-422/RS-485 CV-485 of Ekodat converter.

In a RS-485 connection the line length must not surpass 1000m, without amplifiers. It is necessary to use shielded pair cable and to connect the screen to pin 9 in the connector DB9 or SAP 12 (depending on the display version). The transmission line must be placed away from high power lines. Branches from the network to the displays must be as short as possible.

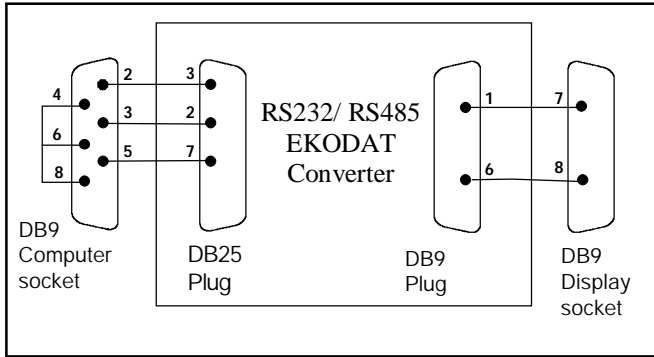
There are two connections available, depending on the program you are using to communicate with the display.

First diagram:



3.2.4a RS-485 connection between DT-105X, DT-106X, DT-110X, DT-111X and DT-203X, with a PC and a CV-485 EKODAT converter.

Second diagram:



3.2.4b RS-485 connection between DT-105X, DT-106X, DT-110X, DT-111X and DT-203X, with a PC and a CV-485 EKODAT converter.

Switch	Function	Position	
		ON	OFF
1	120 Ω in RD	With resistor	Without resistor
2	120 Ω in SD	With resistor	Without resistor
3 and 4	Join RDB with SDB and RDA with SDA	RS-485	RS-232
5	Control RTS	Auto RTS	Normal

Position of the microswitches in configuration:

2,3,4 and 5 - ON

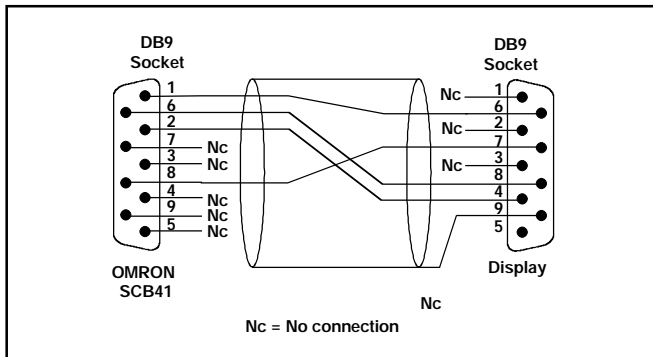
1 and 6 - OFF

3.2.5 RS-422 Connection between DT-105X, DT-106X, DT-110X, DT-111X y DT-203X, and a SCB41 OMRON connection kit.

In a RS-422 connection the line length must not surpass 1000m, without amplifiers. It is necessary to use shielded pair cable and to connect, between the display and the converter, the screen to pin 9 in the connector DB9 or SAP 12 (depending on the display version). The transmission line must be placed away from high power lines. Branches from the network to the displays must be as short as possible.

Resistors of 120 Ohm must be set at the end of the line to ensure that the network is in good working order.

In connector DB9 there is enough space to set the resistance together with the connection.



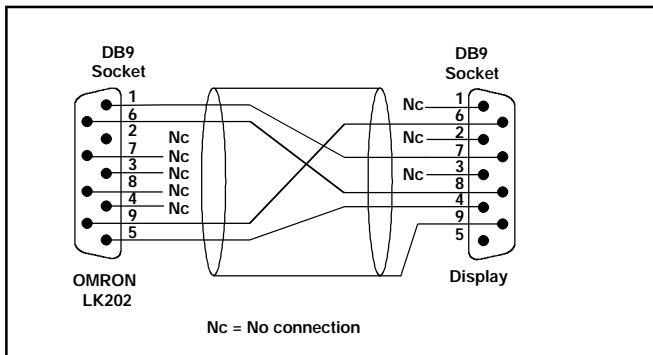
3.2.5 RS-422 connection between DT-105X, DT-106X, DT-110X, DT-111X and DT-203X, with a SCB41 OMRON connection kit.

3.2.6 RS-422 Connection between DT-105X, DT-106X, DT-110X, DT-111X and DT-203X, and a LK202 OMRON connection kit.

In a RS-422 connection the line length must not surpass 1000m, without amplifiers. It is necessary to use shielded pair cable and to connect, between the display and the converter, the screen to pin 9 in the connector DB9 or SAP 12 (depending on the display version). The transmission line must be placed away from high power lines. Branches from the network to the displays must be as short as possible.

Resistors of 120 Ohm must be set at the end of the line to ensure that the network is in good working order.

In connector DB9 there is enough space to set the resistance together with the connection.

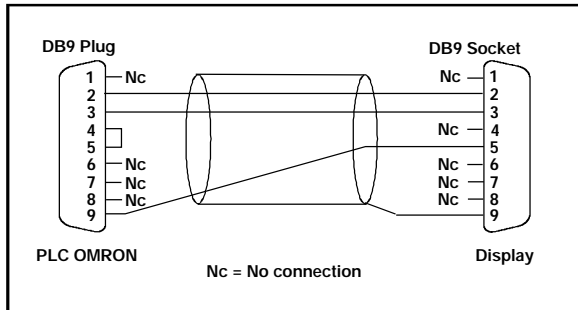


3.2.6 RS-422 connexion wire between DT-105X, DT-106X, DT-110X, DT-111X and DT-203X with LK202 OMRON communication card

3.2.7 RS-232 Connection between DT-105X, DT-106X, DT-110X, DT-111X and DT-203X, and Omron PLC.

In a RS-232 connection the line length must not surpass **5m**. It is important to use shielded cable and to connect the screen to pin 9 in the connector DB9 or SAP 12 (depending on the display version).

The transmission line must be placed away from high power lines.

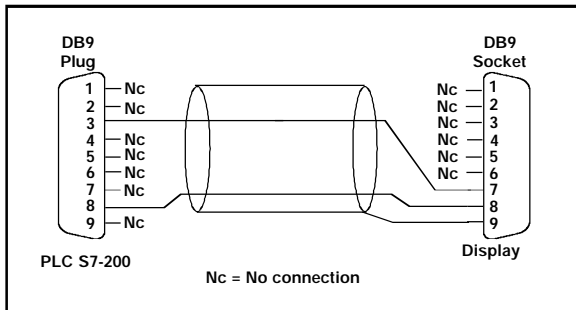


3.2.7 RS-232 Connection cable between DT-105X,DT-106X, DT-110X, DT-111X and DT-203X with Omron PLC

The connector type (plug or socket) corresponds to the cable.

3.2.8 RS-485 Connection between DT-105X, DT-106X, DT-110X, DT-111X and DT-203X, and a Siemens PLC S7-200.

In a RS-485 connection the line length must not surpass 1000m, without amplifiers. It is necessary to use shielded pair cable and to connect the screen to pin 9 in the connector DB9. The transmission lines must be placed away from high power lines.



3.2.8 RS-485 connection between DT-105X, DT-106X, DT-110X, DT-111X and DT-203X with a Siemens PLC S7-200

The connector type (plug or socket) corresponds to the cable.

Resistors of 120 Ohm must be set at the end of the line to ensure that the network is in good working order.

In connector DB9 there is enough space to set the resistance together with the connection.

4.- Working.

4.1 Initial reset.

The series DT105/106/110/111/203/X displays are industrial displays controlled by serial line RS-232 or RS-485, from 1 to 8 rows and 1 or 2 display sides.

Before connecting the display to the power supply, it must be checked that all connections have been set properly and that the display has been firmly fixed. Every time the display is connected to the power supply, there is an initial reset, which check all the points of the display

Following the reset, the display reads the message memory and initialises the messages table. The world «INICI» is shown until the display is prepared to receive messages.

When the initialisation process is finished, the display is ready to receive data. While waiting for the first message the display shows a programmed message depending on the protocol.

LARTET protocol: All programmed messages are shown.

ModBus protocol: Message 0 is shown.

Omron protocol: Message 0 is shown.

ASCII protocol: Message 0 is shown.

S7-200 protocol: Message 0 is shown.

4.2 Message programming

In order to program the messages in the memory Eeprom, a PC and the TDL software are necessary. TDL is software specifically designed to program the messages into the display. See the TDL Manual to know how the TDL works.

To program the messages, the display must be configured with the following parameters: (See Set Parameters)

- 1- Display Address = 000
- 2- Protocol = Lartet
- 3- BaudRate = 9600
- 4- Data length = 8
- 5- Parity = Par
- 6- Stop Bits = 2
- 7- Serial input = Depends on serial line (RS-232 o RS-485).

The program time could take some minutes.

4.3 Set parameters.

Before using the display you must set the parameters.

The parameters are:

- 1- Language.
- 2- Display address.
- 3- Protocol.
- 4- Baud rate.
- 5- Bits length.:
- 6- Parity.
- 7- Stop bits.
- 8- Serial input.
- 9- Test serial L.
- 10- Date
- 11- Time
- 12- End

To set the parameters, the display has a pair of pushbuttons located at the bottom of the case. The menu is in four languages.

4.3.1 Modify parameters

To go into modify parameters menu, you should push the advance pushbutton for more than three seconds, labelled with «7->5». After the 3 seconds, the display shows the first parameter in flashing mode.

From this point, there are two options:

1- Display the parameters value.

By pushing advance ("7->5") you may see the parameters value. The increase pushbutton, labelled «+», lets you modify the parameter.

To select the parameters name push the advance pushbutton («7->5»).

2- Select another parameter.

While the parameter name is flashing, every time you push the increase pushbutton («+») you select a new parameter.

4.3.2 Exit modify parameters

To exit the modify parameters menu, select the parameter «END» and then push advance «7->5».

4.3.3 Meaning of each parameter.

- 1- **Language:** The language menu. There are four languages available: **Catalan, Spanish, French and English.**
- 2- **Address:** The network display address. Selectable between 0 and 299. Depends on each protocol.
- 3- **Protocol:** The selected protocol. The protocols available are: **Lartet, Modbus, Omron, ASCII and S7-200.**
- 4- **Baud Rate:** Selects the transmission baud rate. There are two baud rates available: **9600** and **19200.**
- 5- **Data length:** Selects the transmission data length. Select **7** or **8** bits.
- 6- **Parity:** Selects the transmission parity. Select **Even, Odd** or **None.**
- 7- **Stop Bits:** Selects the transmission number of stop bits. Select **1** or **2.**
- 8- **Serial input:** Selects the transmission type of serial line: **RS-232** or **RS-485**
- 9- **Test serial L.:** Selects the transmission test of serial line. There are three levels :
 - 0** = No test
 - 1** = Test transmission errors
 - 2** = Test transmission errors and display address error.
- 10- **Date:** Allows you to modify the display date.
- 11- **Time:** Allows you to modify the display time.
- 12- **End:** To exit modify parameter menu, push advance ("7->5").

5. Protocols.

Protocols are the procedures used by displays to communicate with other equipment. Each protocol has its own specifications explained in detail in the following paragraphs.

Definitions of words used in protocol descriptions:

Message: Alphanumerical text of one or more lines (according to display model). For each message, a line must be static or dynamic. In static message, line text is equal to or shorter than the number of characters of on a line. Dynamic messages have more characters than the line and are showed scrolling from right to left.

Message number: The number that identifies the message. The valid range is 0 to 512.

Variable: A variable is a group of characters the value of which is set in execution time. At edition time, you must reserve a place for each character variable. A message may display a maximum of 16 variable characters per line. An 8 line display may display 128 characters.

Inside each line, the 16 variable characters can be grouped as you want. 16 variables of 1 character or 1 variable of 16 characters.

Examples:

[v] = Character variable.

TOTAL= [v][v][v] 1 Variable of 3 characters.

PARTIAL= [v][v][v] TOTAL= [v][v][v][v][v]
2 Variables. 1 of 3 characters and 1 of 5 characters

Interface: Is the hardware link between equipment. There are two interfaces RS-232 and RS-485. Both interfaces support all the protocols.

Displays DT-105/106/110/111/203/X have 5 protocols implemented in all models.

- 1- Lartet Protocol. Developed for Lartet products.
- 2- Modbus Protocol. Industrial protocol.
- 3- Omron Protocol. Protocol for Omron products.
- 4- ASCII Protocol. This protocol uses ASCII characters and is easy to implement.
- 5- S7-200 Protocol. Protocol for Siemens S7-200 PLC's.

5.1 LARTET protocol.

The Lartet protocol must be selected to save new messages into the memory.

After power on, the display always shows all messages stored in the memory in **Continuous** mode. The **Continuous** mode is reset when the serial line sends a message to display. In **Message** mode, the display only shows the last message received. To return to continuous mode see section **4.4.4.3 Continuous Mode**.

Every time the display receives a message with its address, the display returns an acknowledge message. This rule is not valid when the message received has address 0 and the address display is > 0. Messages with address 0 are used to send the same message to all displays in a network.

If display address and message address are both 0, the display returns an acknowledged message.

The block structure is:

00 02	Address	Bytes	Data	00 0D	CRC	00 03
-------	---------	-------	------	-------	-----	-------

00 02: Start block. Always 00 02 hexadecimal.

Address: Display address. Address range 00 to FF hexadecimal.

Bytes : Number of bytes.

Data: Message send to display.

00 0D: End of data.

CRC : Crc value.

00 03: End block. Always 00 03 hexadecimal.

5.1.1 Start block.

2 bytes.

Always "00 02" hexadecimal.

5.1.2 Address.

1 byte.

The address display in the network. Valid range between 0 and FF hexadecimal.

The display and the message address allows transmissions to be controlled on the network between one master and up to 255 slaves. The display always acts a slave. The display only acknowledges the message if has its own address. The display only shows the message if it has its own address or it has the address 0.

Message address	Display address	Display answer	Display Message
0	0	YES	New message
2	0	NO	No change
0	1	NO	New message
3	4	NO	No change
3	3	YES	New message

5.1.3.- Number of bytes.

1 byte.

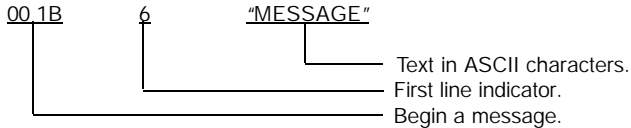
Is the number of bytes which forms the block of information. It begins to count from the byte of the address number to the second byte of CRC, both included. The value of the number of bytes must be, in hexadecimal type, between 6 and 250.

5.1.4.- Data.

The Data consists of the message texts, the control characters and the error codes. The area of data must be started by some control characters, which will define the kind of information which follows.

5.1.4.1 Displaying a message. (ONE LINE DISPLAY)

The structure of the data zone is:



*** Beginning a message: 2 bytes.**

It is "00 1B" in hexadecimal. It must be placed at the beginning of the data block.

*** 1^a line indicator: 1 byte.**

It must always be "06" in hexadecimal. This information is not useful in these kinds of displays, but it must be included to maintain the compatibility with the software of other LARTET displays.

*** Text**

The text to be displayed must be in ASCII code. There are several options to be taken within a text::

"00 08" beginning of blinking, in the following characters.

"00 09" ending of blinking.

"00 15" displaying the date, needs 8 characters.

"00 16" displaying the hour and minutes. It needs 5 characters

"00 18" displaying the hour, minutes and seconds. It needs 8 characters.

The date and time can be displayed in any place in the text. Date and time take characters of variables, and so it consequently, it must be taken into account that in a message, the amount of characters reserved for variables can just take 16 characters.

Example:

Text of display ="PQRSTUV"

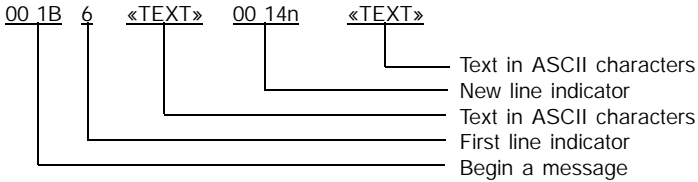
Transmission block:

```

00 02 00 10 00 1B 06 50 51 52 53 54 55 56 00 0D 51 06 00 03
00 02          Start
00           Display num. 0
10          Number of bytes in hexadecimal. (16 decimal)
00 1B       Beginning a message.
06         Indicates the line number
50 51 52 53 54 55 56 Text "PQRSTUV" in ASCII characters
00 0D       Indicates end of data.
51 06       CRC
00 03       End of block
  
```

5.1.4.2 Displaying a message. (MORE THAN ONE LINE)

The structure of the data zone must be:



* Beginning a message: 2 bytes

It must always be "00 1B" in hexadecimal. It must be set once, at the beginning of every block of data.

* Indicator 1^a line

Code "06", steady.

* "Text of line 1"

* Indicator 2^a line

It must always be "00 14" and the line number. Total 3 bytes

* "Text of line 2"

The text to be displayed must be in ASCII code. There are several options within a text:

"00 08" beginning of blinking, in the following characters.

"00 09" ending of blinking.

"00 15" displaying the date. It needs 8 characters.

"00 16" displaying the hour and minutes. It needs 5 characters.

"00 18" displaying the hour, minute and seconds. It needs 8 characters.

"00 22" Brightness adjust. To adjust the display brightness. Valid range is from 1 to 8 in ASCII code hexadecimal.

Example: 00 22 38 Adjust highest brightness.

ONLY WITH HUMIDITY AND TEMPERATURE OPTION

"00 1E" displaying temperature in Celsius. It needs 6 characters.

"00 1F" displaying temperature in Fahrenheit. It needs 6 characters.

"00 21" displaying relative humidity. It needs 2 characters.

The date and time can be displayed from any place in the Text. It takes characters of variables. The amount of characters reserved for variables can just take 16 characters per line.

Example:

DISPLAY Num. = 2

Text line 1 = "LARTET"

Text line 2 = "123456"

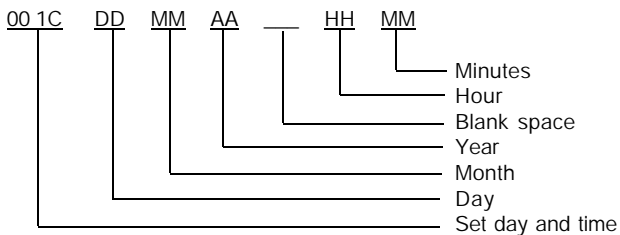
Transmission block:

00 02 02 18 00 1B 06 4C 41 52 54 45 54 00 14 02 31 32 33 34 35 36 00 0D 66 67 00 03

00 02	Start.
02	Display num. 2
18	Number of bytes in hexadecimal. (24 decimal)
00 1B	Beginning a message.
06	It points to the number of line 1
4C 41 52 54 45 54	Text "LARTET" in ASCII characters
00 14 02	It points to the number of line 2
31 32 33 34 35 36	Text "123456" in ASCII characters
00 0D	It indicates end of data.
66 67	CRC
00 03	End of block.

5.1.4.3 Updating Date and Hour of Clock Calendar.

The Clock Calendar can be updated by external push buttons or via software. To modify the date and time it is necessary to send the data, in ASCII, except for the control byte , with the following structure.



The clock seconds reset automatically every time the time is updated..

Example:

DISPLAY Num. = 0
 Day 07/11/01
 Hour 16:08
 Transmission block:
 00 02 00 13 00 1C 30 37 31 31 30 31 20 31 36 30 38 00 0D 12 39 00 03

00 02 Start.
 00 Display num. 0
 13 Num. of bytes in hexadecimal. (19 decimal)
 00 1C Updating date and time.
 30 37 Day 07 in ASCII characters.
 31 31 Month 11 in ASCII characters.
 30 31 Year 2001 in ASCII characters.
 20 Space in characters ASCII.
 31 36 Hour 16 in ASCII characters.
 30 38 Minutes 08 ASCII in characters.
 00 0D End of data.
 12 39 CRC
 00 03 End of block.

5.1.4.4 Set CONTINUOUS mode

In CONTINUOUS mode, the displays shows sequentially all the messages stored in EEPROM. CONTINUOUS mode is set automatically on the display, after reset, unless the address of the display is 0. When a single message is sent via serial line, the CONTINUOUS mode is reset and the message received will be displayed. To set the display to CONTINUOUS mode from serial line a single control code must be sent (00 1D), in the data area into the transmission block.

2 bytes.

It must always be "00 1D" in hexadecimal.

Example.

DISPLAY Num. = ALL displays
 Transmission block:
 00 02 00 08 00 1D 00 0D 00 18 00 03

00 02 Heading.
 00 Display number 0. All displays
 08 Number of bytes in hexadecimal. (16 decimal)
 00 1D Reset presentation mode.
 00 0D End of data.
 00 18 CRC
 00 03 End of block.

5.1.5 End of data

2 bytes.

It is always "00 0D" in hexadecimal.

5.1.6 CRC

2 bytes.

Check redundancy code. The first byte is the result of calculating the OR EXCLUSIVE function of odd bytes. It begins from the terminal number to end of data, both included. The second byte is the result of calculating the OR EXCLUSIVE function of even bytes. It begins from the number of bytes to end of data, both included.

5.1.7 End of block.

Always "00 03" in hexadecimal.

5.1.8 Display acknowledge.

After receiving a transmission block , the display returns an acknowledge block of conformity or error. The returning codes are:

00 02	Address	8	05 xx	00 0D	CRC	00 03
-------	---------	---	-------	-------	-----	-------

Acknowledge codes:

"05 00" No error.

"05 01" Communication error.

"05 02" CRC error.

"05 03" Data block error.

"05 04" Error. It does not find data end.

"05 05" Error. The number of bytes is incorrect.

5.2 ModBus protocol.

This protocol follows the specification of Modbus Protocol RTU mode. This industrial protocol is widely used and easy to adapt to a lot of equipment.

The transmission line may be RS-232 or RS-485. Using RS-232 the maximum length is 5m. The transmission line is selected by modifying the parameters. See 4.3.1.

Modbus protocol uses blanks to control the start and end of block. A blank is the time necessary to transmit 3 characters. Each Baud Rate has a blank time. At the end of block, no equipment may transmit until blank time is elapsed.

While ModBus protocol is selected the display works a slave. After each correct block received the displays sends an acknowledge block.

Transmission block

Address	10h	Control	First	Words High	Words Low	Bytes	Data	CRC Low	CRC High
---------	-----	---------	-------	---------------	--------------	-------	------	------------	-------------

Address: The display address

10h: ModBus code. Always 10 in hexadecimal.

Control: Control mode and line number.

First: Position of first character sent.

Words high and Words low: Number of words sent into data.

Bytes: Number of bytes sent into data.

Data: Data sent to display.

CRC low and CRC high: CRC value.

The ModBus protocol allows you to work in two different modes:

- 1- **Direct control:** Its necessary to send all characters by the serial line.
- 2- **Code control:** Its necessary to send the message number. Use TDL software to edit messages and store them in Eeprom display's memory.

5.2.1.- Display address.

1 Byte.

It is the number that identifies the display on network. Valid range between 0 and FF hexadecimal. To modify the display address see **4.3.1 Modify parameters.**

5.2.2.- MODBUS code: write n words.

1 Byte.

It is always the value of decimal. 10 hexadecimal.

5.2.3.- Control

1 Byte.

This byte performs more than one function. If D7 bit is 0, all the characters in ASCII code must be sent to display. Bits D0-D3 specify in which line the text will begin.

If D7 bit is 1, the number of message must be sent to display. Use TDL software to edit messages and store them in Eeprom display's memory.

D7	D6	D5	D4	D3	D2	D1	D0
----	----	----	----	----	----	----	----

Direct Control: D7 = 0. Send all the characters in ASCII code.
D0-D3 = Number of first line to place the text received.

Code Control: D7 = 1. Send the number of message.

5.2.4.- First.

1 Byte.

Direct control:

The position of the first character is sent to the display. Position 1 is the one placed on the left side of the display. The character placed on the left of the first character should not be modified.

Position =1: Only the new text which has been sent is displayed.

Position >1: The current text is modified and it begins with the position sent. If the characters just sent modify other characters belonging to the previous message, new characters make the previous message longer. If the amount of characters sent is lower than the amount of characters remaining from the first modified character to the end of the previous message, there are 2 possibilities:

A) The sent text ends with 0DH code: What remains from the previous message is not deleted and it is not modified.

B) The sent text does not end with 0Dh code. What remains from the previous message is not deleted and it is not modified.

Example 1: present text: «ABCDEFGHJKLMN»
Position of the first character: 4
Text sent: «1234»
Final text: «ABCD1234HIJKLMN»

Example 2: present text: «ABCDEFGHJKLMN»
Position of the first character: 4
Text sent: «1234+ (0DH) = ASCII: 31 32 33 34 OD
Final text: «ABC1234»

Code control: This byte is not used on code control.

5.2.5.- Number of words.

2 Bytes.

It is the number of words sent on network. It is to monitor the block of information received.

5.2.6.- Number of characters.

1 Byte.

It is the number of characters of the message. It has to be an even number.

5.2.7.- Data.

Minimum 4 Bytes.

See **4.6.9 Structure of Data block.**

5.2.8.- CRC.

2 Bytes.

It is the result from CRC according to J-BUS/MODBUS protocol. The CRC is made of all characters except the resulting Crc using the following process.

- 1- Assign the value FFFFh to CRC register.
- 2- Make an exclusive OR between the CRC register and the first byte, store the result in CRC register.
- 3- Right rotation of CRC register. Copy LSB to carry bit and set MSB to 0.
4. If Carry bit is equal to 1 make an exclusive OR between CRC register and the value A001h, store the result in CRC register.
5. Repeat point 3 and 4 8 times.
6. Repeat points 2 to 5 until all the bytes are complete.
7. Assign the result to CRC high and CRC low.

5.2.9 - Structure of data block.

5.2.9.1- Direct control.

Data to be sent must be set in ASCII code and will be displayed on the programmed line on byte 3 (4 least significant bits Line number / control types).

The control codes to be sent are:

0A: 0A control codes force a change of line on multilinear displays. If the new text is shorter than the previous one, the characters remaining from the previous message will not be deleted.

0C: 0C control codes force a change of line on multilinear displays. If the new text is shorter than the previous one, the characters remaining from the previous message will be deleted.

Example: Present text «ABCDEFGHJIJ»

Send text «123456» + code 0A. Final text «123456GHIJ»

Send text «123456» + code 0C. Final text «123456»

00 08: It makes the characters flash

00 09: It makes the characters stop flashing.

00 15: Displaying the date.

00 16: Displaying time (hours and minutes)

00 18: Displaying time (hours, minutes and seconds).

00 1C: Time set.

Format: ddmmaa_hhmm (in ASCII characters)

Example: Set date on 18/04/2000 and at 10:34

Display address = 2.

Sent to the data:

02 10 00 01 00 06 0C 1C 31 38 30 34 30 30 20 31 30 33 34 CRC

0A or 0C characters (in hexadecimal) force a change of line on multilinear displays. It allows all the lines from a single display to be sent in just one data block.

Example: Display of 8 lines. Address 2

Sent code: 02 10 04 01 00 04 08 31 32 33 34 0A 41 42 43 CRC

Modify line 4 to: 1234, modify line 5 to: ABC.

The rest of lines are not modified.

Code 00 is transparent and therefore any character will not be displayed

00 22 Brightness adjust. To adjust the display brightness. Valid range is from 1 to 8 in ASCII code hexadecimal.

Example: 00 22 38 Adjust highest brightness.

ONLY WITH HUMIDITY AND TEMPERATURE OPTION

00 1E: displaying temperature in Celsius. It needs 6 characters.

00 1F: displaying temperature in Farenhait. It needs 6 characters.

00 21: displaying relative humidity. It needs 2 characters.

5.2.9.2- Control by code.

Message without variables.

The message number is in the two first bytes of the data block.

Data block. Minimum 4 bytes.

B1	B2	B3	B4
----	----	----	----

B1: MSB of message number. In hexadecimal.

B2: LSB of message number. In hexadecimal.

B3: Always 0.

B4: Always 0.

Message with variables.

The message number is the two first bytes of the data block. See Message without variables.

The position and values of variables follow the message number with this format:

Pv	Nc	Dv
----	----	----

Pv: Position of variable.

Nc: Format and character number.

Dv: Variable data.

Pv: Position of variable. 1Byte.

Every line can display up to 16 variable characters.

A display of eight lines can display up to 128 variable characters. (16 for every line)

The variable positions are:

Line	Position in decimal	Position in hexadecimal
1	1-16	1-10
2	17-32	11-20
3	33-48	21-30
4	49-64	31-40
5	65-80	41-50
6	81-96	51-60
7	97-112	61-70
8	113-128	71-80

A variable position is independent of used variables, this means that although no variable is used in line 2, the first variable on line 3 is in position 33.

The variable position must be in hexadecimal code.

Nc: Format and character number. 1Byte.

D7	D6	D5	D4	D3	D2	D1	D0
----	----	----	----	----	----	----	----

D7-D5 Variable format. It means how to send the variable: In ASCII, in hexadecimal

Bits D7-D5 = 000 Variable in ASCII code in hexadecimal.

Needs 1 variable character when the message is edited.

Example:

Variable sent: 42H. Value displayed: B

Bits D7-D5 = 001 Variable in 1 byte hexadecimal. Displayed in hexadecimal.

Needs 2 variable characters when the message is edited

Example:

Variable sent: 87H. Value displayed: 87

Bits D7-D5 = 010 Variable in 1 byte hexadecimal. Displayed in decimal.

Needs 3 variable characters when the message is edited

Example:

Variable sent: 87H. Value displayed: 135

Bits D7-D5 = 011 Variable in 2 byte hexadecimal. Displayed in hexadecimal.

Needs 4 variable characters when the message is edited

Example:

Variable sent: 8765H. Value displayed: 8765

Bits D7-D5 = 100 Variable in 2 byte hexadecimal. Displayed in decimal.

Needs 5 variable characters when the message is edited

Example:

Variable sent: 8765H. Value displayed: 34661

In Bits D4-D0 must be the number of characters sent.

Dv: Variable data.

The data variable must be sent using the data format selected in byte Nc.

Because the data block must be an even number of bytes, you could use character 00h to complete the data block.

To send variables data of more than one line you could repeat the structure

as many times as you need.

Pv	Nc	Dv
----	----	----

5.2.10 - Acknowledge block.

After a transmission block is received, an acknowledge block is sent with the result.

No error acknowledged.

Address	10h	Control	First	Words High	Words Low	CRC low	CRC High
---------	-----	---------	-------	---------------	--------------	---------	-------------

Address: The display address

10h: ModBus code. Always 10 in hexadecimal.

Control: Control mode and line number.

First: Position of first character send.

Words high and Words low: Number of words sent into data.

CRC low and CRC high: CRC value.

Error acknowledged.

Address	90h	Error code	CRC low	CRC High
---------	-----	---------------	---------	-------------

Address: The display address

90h: ModBus error code. Always 90 in hexadecimal.

Error code: The valid error codes are:

02 = Crc error.

03 = Data block error.

CRC low and CRC high: CRC value.

5.3 - Omron protocol.

Omron protocol supports two kinds of messages. Messages with and without variables. With this protocol the display may control as many as 6 messages without variables and 4 messages with variables together. All messages are shown sequentially.

To know what message should be shown, the display reads a table of 18 DM's from the PLC memory. The **first DM number** must be configured into the **DM parameter**. This parameter is specific for this protocol.

The next table shows the meaning of each DM

DM Number	
DM n	Number of Message without variables 1
DM n+1	Number of Message without variables 2
DM n+2	Number of Message without variables 3
DM n+3	Number of Message without variables 4
DM n+4	Number of Message without variables 5
DM n+5	Number of Message without variables 6
DM n+6	Number of Message with variables 1
DM n+7	Number of Message with variables 2
DM n+8	Number of Message with variables 3
DM n+9	Number of Message with variables 4
DM n+10	Number of DM where variable 1 is located
DM n+11	Total number of DM's of variable 1
DM n+12	Number of DM where variable 2 is located
DM n+13	Total number of DM's of variable 2
DM n+14	Number of DM where variable 3 is located
DM n+15	Total number of DM's of variable 3
DM n+16	Number of DM where variable 4 is located
DM n+17	Total number of DM's of variable 4

5.3.1 - Set a message without variables.

When you want to set a message without variables, you should put the Message Number into a free place on the DM table, between positions DM n and DM n+5. If more than one message is set, the position into the table is used to control the order in which messages will be displayed.

5.3.2 Reset a message without variables.

To reset messages without variables, you must set its position on the table to 0 or change the message number for the other message number.

Examples:

DM parameter = 108	
DM 108	0
DM 109	0
DM 110	15
DM 111	0
DM 112	0
DM 113	0

Message 15 ON

DM parameter = 2145	
DM 2145	4
DM 2146	0
DM 2147	0
DM 2148	156
DM 2149	0
DM 2150	0

Messages 4 and 156
ON

DM parameter = 1	
DM 1	2
DM 2	6
DM 3	0
DM 4	0
DM 5	0
DM 6	24

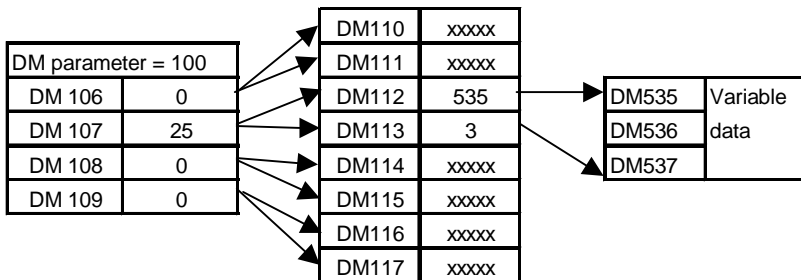
Messages 2,6 and 24
ON

5.3.3 - Set a message with variables.

When you want to set a message with variables, you should put the Message Number into a free place on the DM table, between positions DM n+6 and DM n+9. If more than one message is set, the position into the table is used to control the order in which messages will be displayed.

Using Messages with variables, besides the message number, you must program the position where the variable will be found inside the PLC. Programm the position and the DM number from DM n+10 to DM n+17. Every one of the four messages with variables has 2 DM's for variable data. These 2 DM's work as indirect addressing, first DM has the address where the data is located while the second DM has the number of DM used.

Example.



DM107 = 25 Set message 25.

DM107 Address of Variable Data in DM112 and DM113.

DM112 = 535 => Variable data in DM535

DM113 = 3 => 3 DM used. DM535, DM536 and DM537.

DM535 to DM537 = Variable data. (See paragraph 5.4.6)

5.3.4 Reset a message with variables.

To reset a message with variables, you must set its position on the table to 0 or change the message number for the other message number.

5.3.5 Reset all messages .

To reset all messages, you must set all positions from DM n to DM n+9 to 0.

5.3.6 Data variables.

The data variables must be placed into groups of consecutive DM's for each message. You may use only one group of DM's for all messages or use a different group of DM's for each message.

The variable data block structure is:

First DM		Second DM	Last DM
Position of variable	Number of characters	4 Characters variable	4 Characters variable	4 Characters variable

The position of each character variable in the message is defined at edition time. Position 1 corresponds to the variable character furthest to the left in line 1. Line 1 is the top line in displays of more than one line.

Line	Position in decimal	Position in hexadecimal
1	1-16	1-10
2	17-32	11-20
3	33-48	21-30
4	49-64	31-40
5	65-80	41-50
6	81-96	51-60
7	97-112	61-70
8	113-128	71-80

A variable position is independent of used variables, this means that although no variable is used in line 2, the first variable in line 3 is in position 33.

The variable position must be in hexadecimal code.

Example:

Edited message 34 on a 3-line display:

Line 1: CODE: [v][v][v][v] P=[v][v][v] T=[v][v][v]

Line 2: RESULT: [v][v][v][v] M= [v][v]%

Line 3: TOTAL : [v][v][v][v][v][v][v][v]

Program next values:

Line 1: CODE:3578 P=632 T=890

Line 2: RESULT: 5332 M= 89%

Line 3: TOTAL: 12345678

Option 1: Modify all the values line to line.

DM425	DM426	DM427	DM428	DM429	DM430	DM431	DM432	DM433
109	3578	6328	90XX	1106	5332	89XX	2108	1234
DM434								
5678								

DM425 Modifies line 1. DM429 Modifies line 2. DM432 Modifies line 3.

Option 2: Modifies the values of each variable.

DM110	DM111	DM112	DM113	DM114	DM115	DM116	DM117	DM118
104	3578	503	632X	803	890X	1104	5332	1502
DM119	DM120	DM121	DM122					
89XX	2108	1234	5678					

In DM's 110, 112, 114, 116, 118, and 120 there are the position and character numbers
In DM's 111,113,115,117,119,121 and 123 there are the values.

Notes:

No more than 30 DM can be read at the same time.

No more than 99 characters can be modified at the same time.

5.4 - ASCII protocol.

The ASCII protocol is an easy protocol to connect between the display and any kind of equipment with a serial line, like a PC. This protocol also allows displays to be connected in a network by means of an RS-485 interface.

In this protocol, the display works a slave. It waits to receive a transmission block and if it is correct, acknowledges the block and display data.

Transmission block.

	Start	Address high	Address low	Code	Data	End
ASCII	@	0 to 9	0 to 9	E D	AZ	* CR
HEXA	40	30 to 39	30 to 39	45 44	41 5A	2A 0D

Start: 1 Byte. Always 40h

Address: 2 Bytes. Display address. Valid range 0 to 99. All messages sent with address 0 are accepted for all displays in the network but none acknowledges the block.

Code: 2 Bytes. Always ED (45 44 h)

Data: From 1 to 160 Bytes. Message sent to display. The first character is placed furthest to the left on display.

Special characters:

0A = New line. Valid in more than one-line displays.

08 = Start of flashing characters.

09 = End of flashing characters.

00 15 = Display date in format dd/mm/yy.

00 16 = Display time in format hh:mm.

00 18 = Display time in format hh:mm:ss

00 1C = Set date and time. Format ddmmyy hhmm.

00 22 Brightness adjust. To adjust the display brightness. Valid range is from 1 to 8 in . ASCII code hexadecimal.

Example: 00 22 38 Adjust highest brightness.

ONLY WITH HUMIDITY AND TEMPERATURE OPTION

00 1E displaying temperature in Celsius. It needs 6 characters.

00 1F displaying temperature in Fahrenheit. It needs 6 characters.

00 21 displaying relative humidity. It needs 2 characters.

End: 2 bytes. Always * CR (2A 0Dh).

5.4.1 Acknowledged block.

The display sends an acknowledged block if the address of received block is greater than 0 and equal to the display address.

	Start	Address high	Address low	Code	Acknowledge	End
ASCII	@	0 to 9	0 to 9	E D	0	* CR
HEXA	40	30 to 39	30 to 39	45 44	30	2A 0D

Example 1:

Display the message: «LOW LEVEL» in address display 4

	Start	Address high	Address low	Code	Data	End
ASCII	@	0	4	E D	LOW LEVEL	* CR
HEXA	40	30	34	45 44	4C 4F 57 20 4C 45 56 45 4C	2A 0D

Example 2:

Display the message: « TIME: 09:50». 09:50 is the display time

Display address: 12

	Start	Address high	Address low	Code	Data	End
ASCII	@	1	2	E D	TIME: 16h	* CR
HEXA	40	31	32	45 44	54 49 4D 45 3A 20 16	2A 0D

5.5 S7-200 protocol.

S7-200 protocol is the protocol designed to connect with Siemens PLS's S7-200 series using PPI port.

S7-200 protocol supports two kinds of messages. Messages with and without variables. With this protocol the display may control as many as 6 messages without variables and 4 messages with variables together. All messages are shown sequentially.

To know what the messages should be shown, the display reads a table of 18 VW's from the PLC memory. The **first VW number** must be configured into the **parameter VW**. This parameter is specific to this protocol.

The **slave number** is also a specific parameter for this protocol. It is used to code the PLC address into the PPI network. By default S7-200 is assigned to address 2.

The next table shows the meaning of each VW

VW Number	
VW n	Number of message without variables 1
VW n+ 2	Number of message without variables 2
VW n+ 4	Number of message without variables 3
VW n+ 6	Number of message without variables 4
VW n+ 8	Number of message without variables 5
VW n+ 10	Number of message without variables 6
VW n+ 12	Number of message with variables 1
VW n+ 14	Number of message with variables 2
VW n+ 16	Number of message with variables 3
VW n+ 18	Number of message with variables 4
VW n+ 20	Number of VW where variable 1 is located
VW n+ 22	Total number of VW's of variable 1
VW n+ 24	Number of VW where variable 2 is located
VW n+ 26	Total number of VW's of variable 2
VW n+ 28	Number of VW where variable 3 is located
VW n+ 30	Total number of VW's of variable 3
VW n+ 32	Number of VW where variable 4 is located
VW n+ 34	Total number of VW's of variable 4

5.5.1 - Set a message without variables.

When you want to set a message without variables, you should put the Message Number into a free place on the VW table, between positions VW n and VW n+5. If more than one message is set, the position in the table is used to control the order in which the messages will be displayed.

5.5.2 Reset a message without variables.

To reset message without variables, you must set its position on the table to 0 or change the message number for other message number.

Examples:

Parameter VW = 108	
VW 108	0
VW 110	0
VW 112	15
VW 114	0
VW 116	0
VW 118	0

Parameter VW = 2145	
VW 2145	4
VW 2147	0
VW 2149	0
VW 2151	156
VW 2153	0
VW 2155	0

Parameter VW = 0	
VW 0	2
VW 2	6
VW 4	0
VW 6	0
VW 8	0
VW 10	24

Message 15 ON

Messages 4 and 156 ON

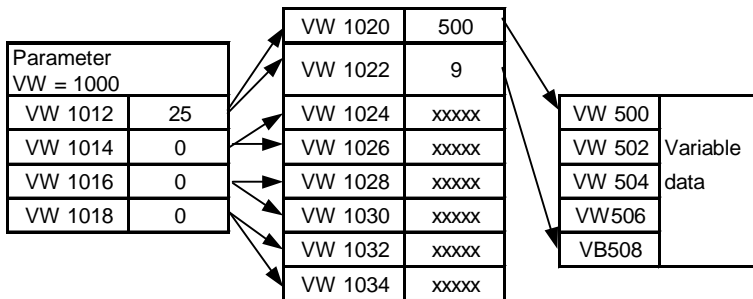
Messages 2, 6 and 24 ON

5.5.3 - Set a message with variables.

When you want to set a message with variables, you should put the Message Number into a free place on the VW table, between positions VW n+6 and VW n+9. If more than one message is set, the position in the table is used to control the order in which messages will be displayed.

Using Messages with variables, besides the message number, you must program the position where the variable is located in the PLC. Program the position and the VW number from VW n+20 to VW n+34. Every one of the four messages with variables has 2 VW's for variable data. These 2 VW's work as an indirect addressing, the first VW has the address where the data is placed while the second VW has the number of VW used.

Example.



VW 1012 = 25 Set message 25.

VW 1025 = 500 The variable data are located at VW 500.

VW 1026 = 9 9 VB's from VW 500 to VB 508. Use VW or VB not significant, but remember that a VW occupies two VB's.

VW 500 a VW 506 = Variable data. (See paragraph 5.5.6)

5.5.4 Reset a message with variables.

To reset a message with variables, you must set its position on the table to 0 or change the message number for another message number.

5.5.5 Reset all messages .

To reset all messages, you must set all positions from VW n to VW n+9 to 0.

5.5.6.- Data variables

The data variables must be placed into groups of consecutive VW's for each message. You may use only one group of VW's for all messages or use a different group of VW's for each message.

The variable data block structure is:

First VW		Second VW	Last VW
Position of variable	Number of characters	2 ASCII character variable	2 ASCII character variable	2 ASCII character variable

The position of each character variable in the message is defined when editing. Position 1 corresponds to the character furthest to the left on line 1. Line 1 is the top line on displays of more than one line.

Line	Decimal position	Hexadecimal position
1	1 - 16	1 - 10
2	17 - 32	11 - 20
3	33 - 48	21 - 30
4	49 - 64	31 - 40
5	65 - 80	41 - 50
6	81 - 96	51 - 60
7	97 - 112	61 - 70
8	113 - 128	71 - 80

A variable position is independent of used variables, this means that although no variable is used in line 2, the first variable in line 3 is in position 33.

The variable position must be in hexadecimal code.

5.5.7.- Examples S7-200

IMPORTANT: To store the messages in the display you should use TDL software. See 4.2 Message programming.

Example of a message without variables.

Messages 12 and 53 must be stored in the display. Use these texts as examples.:

Message 12: OIL PUMP

Message 53: TANK 2 FULL

The PLC program will be as follows.

```
//  
//EXAMPLE PROGRAM FOR MESSAGES WITHOUT VARIABLES  
//  
// The display parameter VW must be equal to 1000.  
// Input I0.0 ON, sets message 12.  
// Input I0.1 ON, sets message 53.  
// Input I0.2 ON, resets messages 12 and 53.  
  
NETWORK 1 //Set message 12  
// If input I0.0 is ON a value of 12 is stored in VW1000.  
LD I0.0  
MOVW +12, VW1000  
  
NETWORK 2 //Set message 53  
// If input I0.1 is ON a value of 53 is stored in VW1002.  
LD I0.1  
MOVW +53, VW1002  
  
NETWORK 3 // Reset messages 12 and 53  
// If input I0.2 is ON a value of 0 is stored in VW1000 and VW1002  
LD I0.2  
MOVW +0, VW1000  
MOVW +0, VW1002
```

Prior to establishing the transmission between the PLC and display, don't forget to set the display parameters. To set the display and PLC address in the PPI network see section 4.3.

Message with variable example.

The values of two counters are displayed in a message.

The PLC program will be as follows.

// The display parameter VW must be equal to 1000.

//Message 25 is used.

//The text message is: LONG=[V][V][V][V] SHORT=[V][V][V]

// Input I0.0 ON resets the message 25

// Input I0.1 ON sets the message 25

// Input I0.2 ON increments LONG counter

// Input I0.3 ON increments SHORT counter

// Input I0.4 ON resets both counters.

NETWORK 1 //Resets message 25

LD I0.0

MOVW +0, VW1012

NETWORK 2 //Sets message 25

LD I0.1

MOVW +25, VW1012 // Set message 25

MOVW +500, VW1020 // Variable data into VW500 register

MOVW +9, VW1022 // 9 VB registers VB

MOVB 1, VB500 // Put variable data from position 1

MOVB 16#07, VB501 // Data are 7 characters long.

MOVW VW528, VW502 // LONG data value

MOVW VW530, VW504 // LONG data value

MOVW VW549, VW506 // SHORT data value

MOVB VB551, VB508 // SHORT data value

NETWORK 3 // Increment counter LONG

LD I0.2

A SM0.5

EU

INCD VD400

DTA VD400, VB520, 16#00 // ASCII Conversion

NETWORK 4 // Increment counter SHORT

LD I0.3

A SM0.5

EU

INCD VD410

DTA VD410, VB540, 16#00 // ASCII Conversion

NETWORK 5 // Reset counters

LD I0.4

MOVD +0, VD400

MOVD +0, VD410

DECLARATION OF CONFORMITY



Tetralec S.L.
c/ Severo Ochoa, 80
Polígono Industrial Coll de la Manyà
08400 Granollers

As the manufacturer of the brand **LARTET** equipment:

Serial line alphanumeric display.

Mòdel : DT-105X in all versions.

Mòdel : DT-106X in all versions.

Mòdel : DT-110X in all versions.

Mòdel : DT-111X in all versions.

Mòdel : DT-203X in all versions.

We state under own responsibility that the above mentioned product complies with the following European:

Regulation: 73/23/CEE Regulation of low voltage

Standard EN61010-1 Security in electric equipment

Regulation: 89/336/CEE Regulation of electromagnetic compatibility

Standard UNE-EN 50081-2 Generic emission standard.Industrial environment

Standard UNE-EN 50082-2 Generic immunity standard.Industrial environment

Granollers, March 20, 2000

Josep M° Bisbe
Technical Manager