

**OPERATION MANUAL
FOR DISPLAYS SERIES
DN-109X, DN-119X,
DN-129X AND DN-189X**

1196K31R



TETRALEC E.I. S.L.
Certified company

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1. INTRODUCTION

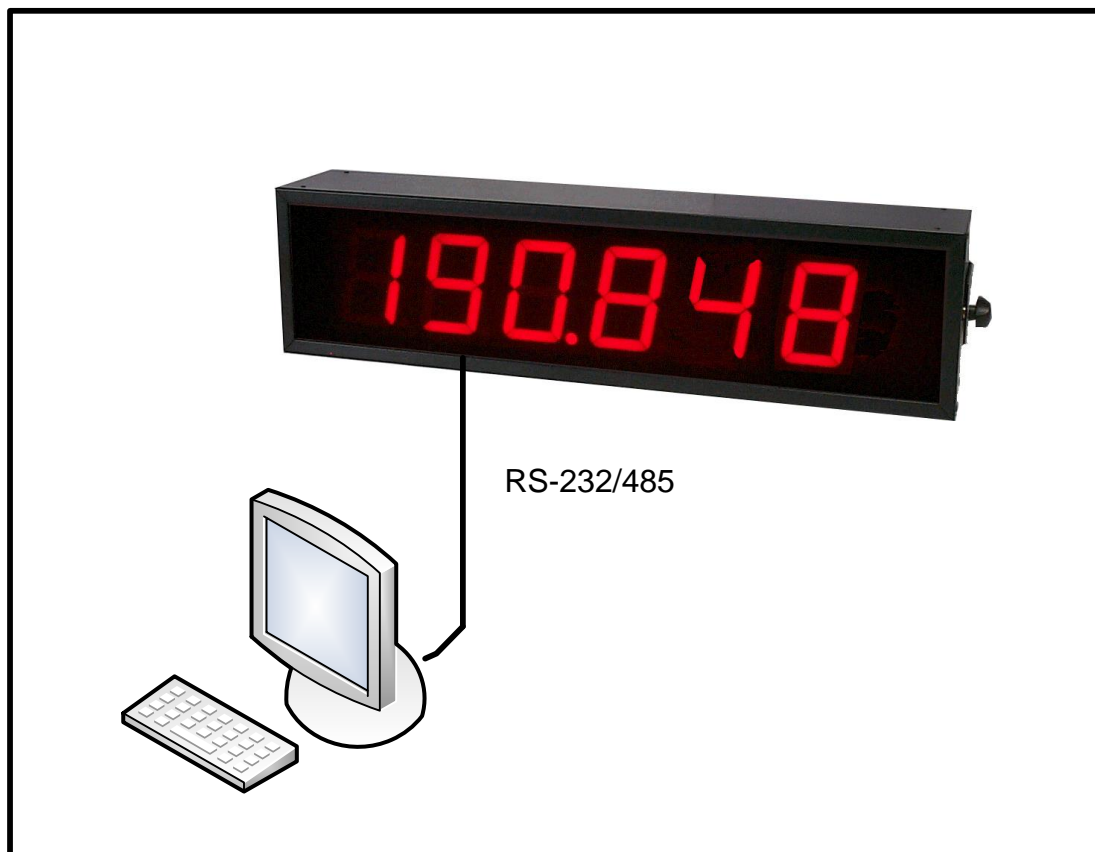
The DN-109X, DN-119X, DN-129X and DN-189X numeric displays are industrial displays with RS-232 and RS-485 serial interface, which can be configured to work with several protocols. All the equipment has the option to add a symbol, in text format, of a maximum of three characters.

The selection of the serial interface, the parameters and the communication protocol are realised by two push buttons with a system of codes of easy programming.

One of its main characteristics is the big characters size

The size of the digits is 57mm for DN-109X, 100mm for DN-119X, 250mm for DN-129X and 180mm for DN-189X. The viewing distance from 30m to 120m, is one of the most interesting characteristics.

These displays have several uses: It can be used for industrial purposes, or as a repeater of other equipment (panel instruments), speed regulator, displaying numeric values from a PLC, a PC or any other equipment which has a RS-232 or RS-485 serial interface.



2. GENERAL CHARACTERISTICS.

2.1. Electrical characteristics

2.1.1. Electrical characteristics of the DN-109 displays.

Supply Voltage	88 to 264 VAC 47 to 63Hz or 19 to 36VDC:
Consumption	See "Display weight and power consumption."
Display	7 segments, 57mm high + decimal point. Red Led colour. Viewing distance: max 30 meters.
Text (LED)	Formed by leds of 5mm diameter, 50mm character height.
Text (Vinyl)	White vinyl. 50mm character height.
Parameter memory	Eeprom.
Communication	RS-232 and RS-485. Option RS-422.
Communication Protocols	All included
Environmental Conditions	Operation Temperature: -20 to 60°C. Storage temperature: -30°C to 70°C. Humidity: 5-95% RH non condensing. Maximum environmental illumination: 1000 lux. Sealing: IP41 or IP65.

2.1.2. Electrical characteristics of the DN-119 displays.

Supply Voltage	88 to 264 VAC 47 to 63Hz or 19 to 36VDC:
Consumption	See "Display weight and power consumption."
Display	7 segments, 100mm high + decimal point. Red Led colour. Viewing distance: max 50 meters.
Text (LED)	Formed by leds of 5mm diameter, 65mm character height.
Text (Vinyl)	White vinyl. 65mm character height.
Parameter memory	Eeprom.
Communication	RS-232 and RS-485. Option RS-422.
Communication Protocols	All included.
Environmental Conditions	Operation Temperature: -20 to 60°C. Storage temperature: -30°C to 70°C. Humidity: 5-95% RH non condensing. Maximum environmental illumination: 1000 lux. Sealing: IP41 or IP65.

2.1.3. Electrical characteristics of the DN-189 displays.

Supply Voltage	88 to 264 VAC 47 to 63Hz or 19 to 36VDC:
Consumption	See "Display weight and power consumption."
Display	7 segments, 180mm high + decimal point. Red Led colour. Viewing distance: max 90 meters.
Text (Vinyl)	White vinyl.
Parameter memory	Eeprom.
Communication	RS-232 and RS-485. Option RS-422.
Communication Protocols	All included.
Environmental Conditions	Operation Temperature: -20 to 60°C. Storage temperature: -30°C to 70°C. Humidity: 5-95% RH non condensing. Maximum environmental illumination: 1000 lux. Sealing: IP41 or IP65.

2.1.4. Electrical characteristics of the DN-129 displays.

Supply Voltage	88 to 264 VAC 47 to 63Hz or 19 to 36VDC:
Consumption	See "Display weight and power consumption."
Display	7 segments, 250mm high + decimal point.
.....	Red Led colour. Viewing distance: max 120 meters.
Text (Vinyl)	White vinyl.
Parameter memory	Eeprom.
Communication	RS-232 and RS-485. Option RS-422.
Communication Protocols	All included.
Environmental Conditions	Operation Temperature: -20 to 60°C.
.....	Storage temperature: -30°C to 70°C.
.....	Humidity: 5-95% RH non condensing.
.....	Maximum environmental illumination: 1000 lux.
.....	Sealing: IP41 or IP54.

2.2. Display weight and power consumption.

2.2.1. DN-109 weight and power consumption.

Reference	Display Weight (kg)	Power (W)	Reference	Display weight (kg)	Power (W)	Reference	Display weight (kg)	Power (W)
DN-109/3S	2,5	5,9	DN-109/3S+TL	3,0	7,9	DN-109/3S+TV	3,0	5,9
DN-109/3D	3,0	10	DN-109/3D+TL	3,0	11,7	DN-109/3D+TV	3,0	10
DN-109/4S	3,0	7,54	DN-109/4S+TL	3,5	9,6	DN-109/4S+TV	3,5	7,54
DN-109/4D	3,5	14,44	DN-109/4D+TL	3,5	15,1	DN-109/4D+TV	3,5	14,44
DN-109/5S	3,0	9,2	DN-109/5S+TL	3,5	11,2	DN-109/5S+TV	3,5	9,2
DN-109/5D	3,5	18	DN-109/5D+TL	4,5	21,7	DN-109/5D+TV	4,0	18
DN-109/6S	3,5	10,7	DN-109/6S+TL	4,0	12,8	DN-109/6S+TV	4,0	10,7
DN-109/6D	4,0	20,85	DN-109/6D+TL	4,5	25	DN-109/6D+TV	4,0	20,85
DN-109/7S	4,0	12,36	DN-109/7S+TL	4,0	14,4	DN-109/7S+TV	4,0	12,36
DN-109/7D	4,5	24,1	DN-109/7D+TL	5,0	28,1	DN-109/7D+TV	5,0	24,1
DN-109/8S	4,0	14	DN-109/8S+TL	4,5	16	DN-109/8S+TV	4,5	14
DN-109/8D	5,0	27,3	DN-109/8D+TL	5,5	31,3	DN-109/8D+TV	5,5	27,3
DN-109/9S	4,5	15,7	DN-109/9S+TL	4,5	17,6	DN-109/9S+TV	4,5	15,7
DN-109/9D	5,0	30,5	DN-109/9D+TL	5,5	34,6	DN-109/9D+TV	5,5	30,5
DN-109/10S	4,5	17,2	DN-109/10S+TL	5,0	19,2	DN-109/10S+TV	5,0	17,2
DN-109/10D	5,5	33,7	DN-109/10D+TL	6,0	37,7	DN-109/10D+TV	6,0	33,7

2.2.2. DN-119 weight and power consumption.

Reference	Display Weight (kg)	Power (W)	Reference	Display weight (kg)	Power (W)	Reference	Display weight (kg)	Power (W)
DN-119/3S	4,0	10,8	DN-119/3S+TL	4,5	13,4	DN-119/3S+TV	4,5	10,8
DN-119/3D	4,0	18	DN-119/3D+TL	5,0	20	DN-119/3D+TV	5,0	18
DN-119/4S	4,5	14	DN-119/4S+TL	5,5	16,6	DN-119/4S+TV	5,5	14
DN-119/4D	5,0	26,6	DN-119/4D+TL	5,5	31,9	DN-119/4D+TV	5,5	26,6
DN-119/5S	5,0	17	DN-119/5S+TL	5,5	19,7	DN-119/5S+TV	5,5	17
DN-119/5D	5,5	32,9	DN-119/5D+TL	6,0	38,1	DN-119/5D+TV	6,0	32,9
DN-119/6S	5,5	20,2	DN-119/6S+TL	6,0	22,8	DN-119/6S+TV	6,0	20,2
DN-119/6D	6,0	39,2	DN-119/6D+TL	6,5	44,5	DN-119/6D+TV	6,5	39,2
DN-119/7S	6,0	23,3	DN-119/7S+TL	7,0	25,9	DN-119/7S+TV	7,0	23,3
DN-119/7D	3,5	25,5	DN-119/7D+TL	7,5	50,8	DN-119/7D+TV	7,5	25,5
DN-119/8S	6,5	26,4	DN-119/8S+TL	7,5	29	DN-119/8S+TV	7,5	26,4
DN-119/8D	7,0	51,6	DN-119/8D+TL	8,0	56,8	DN-119/8D+TV	8,0	51,6
DN-119/9S	7,0	29,4	DN-119/9S+TL	8,0	32	DN-119/9S+TV	8,0	29,4
DN-119/9D	7,5	57,6	DN-119/9D+TL	8,5	62,9	DN-119/9D+TV	8,5	57,6
DN-119/10S	7,5	32,5	DN-119/10S+TL	8,5	35,2	DN-119/10S+TV	8,5	32,5
DN-119/10D	8,0	64	DN-119/10D+TL	9,0	69	DN-119/10D+TV	9,0	64

2.2.4. DN-189 weight and power consumption.

Reference	Display Weight (kg)	Power (W)	Reference	Display weight (kg)	Power (W)
DN-189/2S	4,0	13,3	DN-189/2S+TV	5,5	13,3
DN-189/2D	4,5	25,8	DN-189/2D+TV	6,5	25,8
DN-189/3S	5,0	19,4	DN-189/3S+TV	6,5	19,4
DN-189/3D	6,0	38,2	DN-189/3D+TV	8,0	38,2
DN-189/4S	6,0	25,7	DN-189/4S+TV	7,5	25,7
DN-189/4D	7,5	50,8	DN-189/4D+TV	9,0	50,8
DN-189/5S	7,0	31,8	DN-189/5S+TV	9,0	31,8
DN-189/5D	8,5	63,2	DN-189/5D+TV	10,5	63,2
DN-189/6S	8,5	37,8	DN-189/6S+TV	10,0	37,8
DN-189/6D	10,0	75,5	DN-189/6D+TV	11,5	75,5
DN-189/7S	9,5	44	DN-189/7S+TV	11,0	44
DN-189/7D	11,0	88,1	DN-189/7D+TV	13,0	88,1
DN-189/8S	10,5	50,3	DN-189/8S+TV	12,0	50,3
DN-189/8D	12,5	100,6	DN-189/8D+TV	14,0	100,6
DN-189/9S	11,0	56,6	DN-189/9S+TV	13,0	56,6
DN-189/9D	13,5	113,2	DN-189/9D+TV	15,5	113,2
DN-189/10S	12,0	62,9	DN-189/10S+TV	14,0	62,9
DN-189/10D	15,0	125,8	DN-189/10D+TV	16,5	125,8

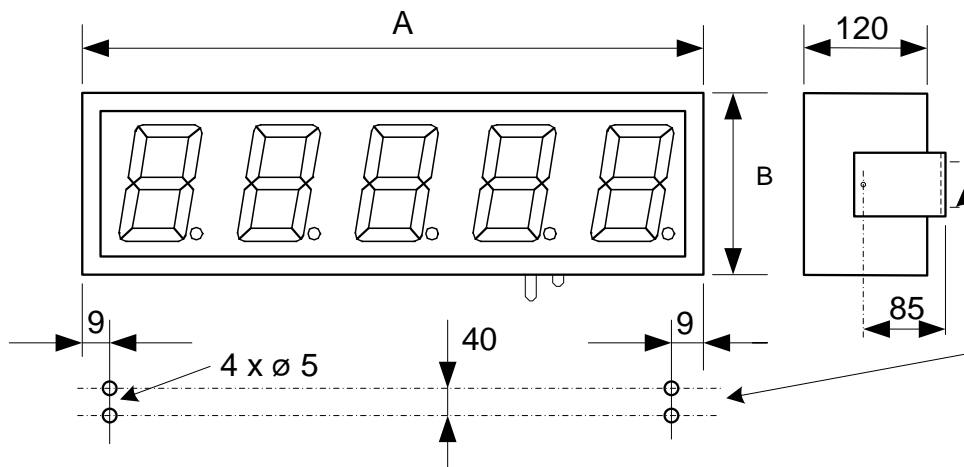
2.2.5. DN-129 weight and power consumption.

Reference	Display Weight (kg)	Power (W)	Reference	Display weight (kg)	Power (W)
DN-129/2S	6,5	13	DN-129/2S+TV	9,5	13
DN-129/2D	8,0	26	DN-129/2D+TV	11,5	26
DN-129/3S	8,5	20	DN-129/3S+TV	11,5	20
DN-129/3D	10,5	40	DN-129/3D+TV	13,5	40
DN-129/4S	10,5	26	DN-129/4S+TV	13,0	26
DN-129/4D	13,0	52	DN-129/4D+TV	16,0	52
DN-129/5S	12,0	32	DN-129/5S+TV	15,0	32
DN-129/5D	15,5	64	DN-129/5D+TV	18,5	64
DN-129/6S	14,0	40	DN-129/6S+TV	17,0	40
DN-129/6D	18,0	77	DN-129/6D+TV	21,0	77
DN-129/7S	16,0	45	DN-129/7S+TV	18,5	45
DN-129/7D	20,0	90	DN-129/7D+TV	23,5	90
DN-129/8S	17,5	51	DN-129/8S+TV	20,5	51
DN-129/8D	23,0	102	DN-129/8D+TV	26,0	102
DN-129/9S	19,5	58	DN-129/9S+TV	22,5	58
DN-129/9D	25,5	115	DN-129/9D+TV	28,5	115
DN-129/10S	21,5	64	DN-129/10S+TV	24,0	64
DN-129/10D	28,0	128	DN-129/10D+TV	31,0	128

2.3. Dimensions and mounting of the Displays

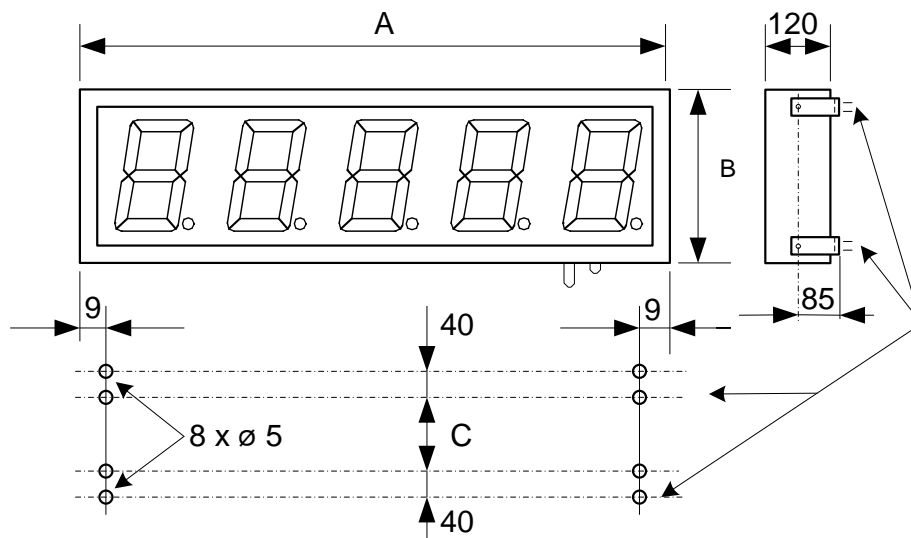
2.3.1. Dimensions and mounting of the DN-109 and DN-119

Reference	A	B	Reference	A	B
DN-109/3S	210	122	DN-109/3S+T	288	122
DN-109/4S	288	122	DN-109/4S+T	336	122
DN-109/5S	288	122	DN-109/5S+T	382	122
DN-109/6S	336	122	DN-109/6S+T	430	122
DN-109/7S	382	122	DN-109/7S+T	478	122
DN-109/8S	430	122	DN-109/8S+T	526	122
DN-109/9S	478	122	DN-109/9S+T	574	122
DN-109/10S	526	122	DN-109/10S+T	622	122
DN-119/3S	324	177	DN-119/3S+T	504	177
DN-119/4S	414	177	DN-119/4S+T	594	177
DN-119/5S	504	177	DN-119/5S+T	684	177
DN-119/6S	594	177	DN-119/6S+T	774	177
DN-119/7S	684	177	DN-119/7S+T	864	177
DN-119/8S	774	177	DN-119/8S+T	954	177
DN-119/9S	864	177	DN-119/9S+T	1044	177
DN-119/10S	954	177	DN-119/10S+T	1134	177



2.3.2. Dimensions and mounting of the DN-129 and DN-189

Reference	A	B	C	Reference	A	B	C
DN-189/2S	340	251	67	DN-189/2S+TV	660	251	67
DN-189/3S	500	251	67	DN-189/3S+TV	820	251	67
DN-189/4S	660	251	67	DN-189/4S+TV	980	251	67
DN-189/5S	820	251	67	DN-189/5S+TV	1140	251	67
DN-189/6S	980	251	67	DN-189/6S+TV	1300	251	67
DN-189/7S	1140	251	67	DN-189/7S+TV	1460	251	67
DN-189/8S	1300	251	67	DN-189/8S+TV	1620	251	67
DN-189/9S	1460	251	67	DN-189/9S+TV	1780	251	67
DN-189/10S	1620	251	67	DN-189/10S+TV	1940	251	67
DN-129/2S	515	366	186	DN-129/2S+TV	985	366	186
DN-129/3S	750	366	186	DN-129/3S+TV	1220	366	186
DN-129/4S	985	366	186	DN-129/4S+TV	1455	366	186
DN-129/5S	1220	366	186	DN-129/5S+TV	1690	366	186
DN-129/6S	1455	366	186	DN-129/6S+TV	1925	366	186
DN-129/7S	1690	366	186	DN-129/7S+TV	2160	366	186
DN-129/8S	1925	366	186	DN-129/8S+TV	2395	366	186
DN-129/9S	2160	366	186	DN-129/9S+TV	2630	366	186
DN-129/10S	2395	366	186	DN-129/10S+TV	2865	366	186



3. INSTALLATION

The installation of the DN-109X, DN-119X, DN-129X and DN-189X is not particularly delicate but some important considerations must be taken into account.

The display must not be anchored to places subject to vibrations, nor should it be installed in places which generally surpass the limits specified in the display characteristics, both in terms of temperature and humidity.

The degree of protection of displays DN-109X, DN-119X, DN-129X and DN-189X is IP41, meaning that they are protected against penetration by solid foreign objects of a diameter of about 1mm and against the vertical fall of water droplets.

Displays DN-109X, DN-119X, DN-129X and DN-189X should not be installed in places with an illumination level in excess of 1000 lux. Neither should the display be placed in direct sunlight as visibility would be lost.

In the electrical installation, proximity to lines of high intensity circulation and high voltage lines must be avoided, as well as proximity to High Frequency generators and U/F converters for motors.

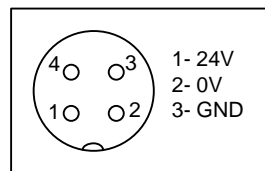
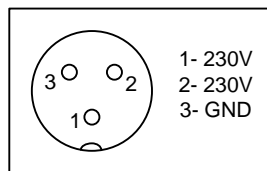
3.1. Power supply.

The power supply must be 88 to 264VAC, 47 to 63 Hz or 19 to 36VDC.

The power supply conductor section will be in line with consumption and the ground conductor will be a minimum section of 1.5m².

The power supply connector for 220VAC has 3 contacts and is situated in the lower part of the unit. Connect the power wires following the schema below

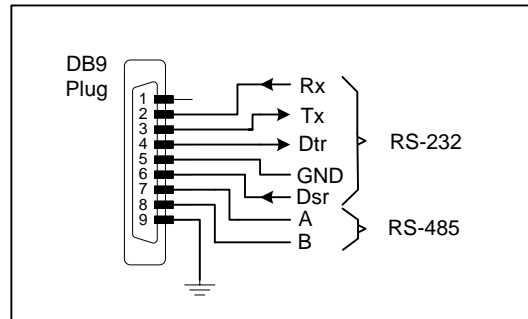
The power supply connector for 24VDC has 4 contacts and is situated in the lower part of the unit. Connect the power wires following the schema below



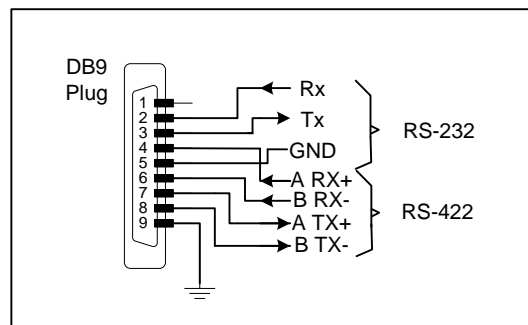
3.2. Serial line connection

All displays DN-109X, DN-119X, DN-129X and DN-189X may use RS232 and RS485 serial lines. Both use the same connector located at the bottom of display.

The DN-109X, DN-119X, DN-129X and DN-189X displays use DB9 connector.



1. RS-232/RS-485 connector



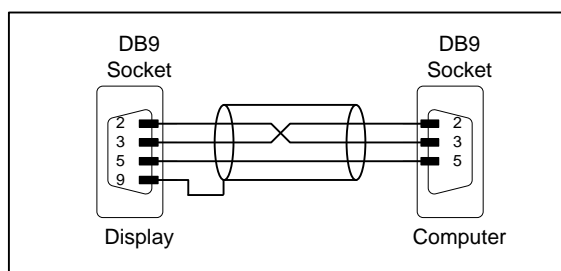
2. RS-232/RS-422 connector

3.2.1. Diagram of the connection between a DN-109/119/129/189X 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.

The transmission line must be placed away from high power lines. The connector shown corresponds to the cable.

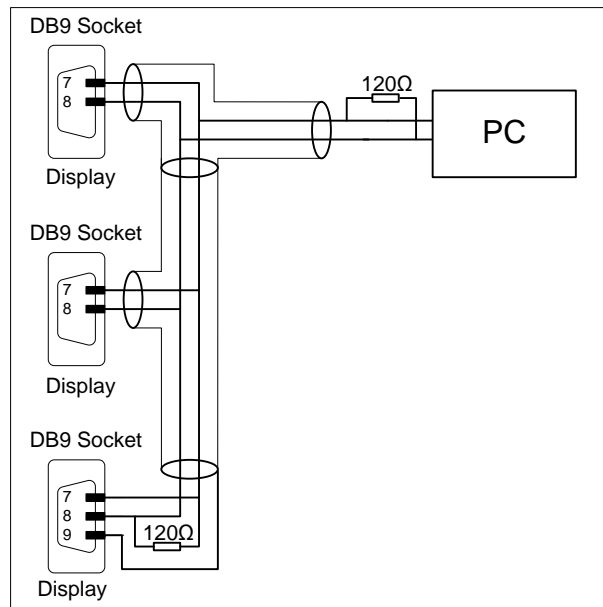


3.2.2. RS-485 Connection diagram between 3 DN-109/119/129/189X displays, and PC.

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 the DB9 connector.

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 120ohm.

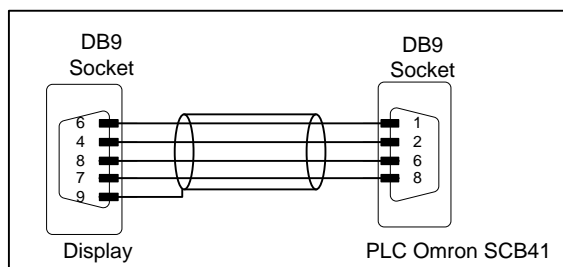


3.2.3. RS-422 Connection between DN-109/119/129/189X and a SCB41 OMRON connection kit.

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 DB9 connector. 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.

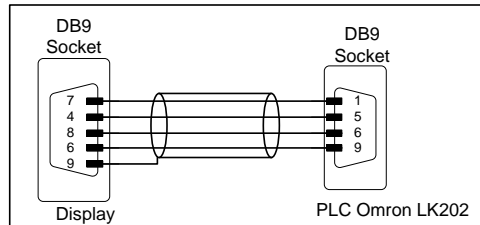


3.2.4. RS-422 connection between DN-109/119/129/189X and a LK202 OMRON connection kit

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 DB9 connector. 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.

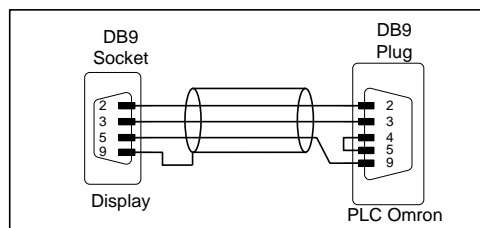
In connector DB9 there is enough space to set the resistance together with the connection.



3.2.5. RS-232 Connection between DN-109/119/129/189X 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 DB9 connector.

The transmission line must be placed away from high power lines. The connector type (plug or socket) corresponds to the cable.



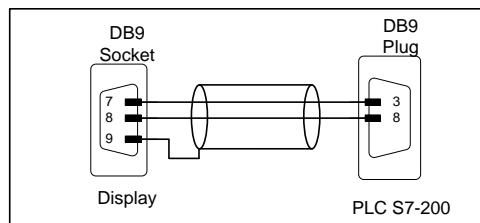
3.2.6. RS-485 Connection between DN-109/119/129/189X and a Siemens PLC S7-200.

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 DB9 connector. The transmission lines must be placed away from high power lines.

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. OPERATION

4.1. Initial reset.

Before connecting the display to the network, we must ensure that all of the connections have been carried out correctly and that the display is firmly in place.

Each time we connect the display to the power supply network, an initial reset occurs which tests all of the segments comprising the display. The test consists of the sequential illumination of all of the digits with the number "8", all of the digits with the value "0", all of the decimal points are lit up and finally the version code. From this point any one of the following three situations may occur:

- The display receives data from the serial line and displays it.
- The display does not receive data and the time without data equals zero. Keeps on showing the decimal points.
- The display does not receive data and the time without data is not equal to zero. After a time without data it displays a dash in each digit.

4.2. Programming parameters.

Displays DN-109X, DN-119X, DN-129X and DN-189X can be adapted to the demands of any customer through the parameters programming. The parameters which can be configured are:

- 1- Display direction on network
- 2- Communication protocol
- 3- Transmission baud rate, data bits, parity, stop bits.
- 4- Type of serial line. RS-232 or RS-485/RS-422.
- 5- Time-out reception.
- 6, 7, 8, 9 and A – Used in some of the communication protocols.
- B, C, D, E, r1, r2 and r3– colour parameters.
- F– Quit menu.

Three digits displays or more:

The three digits on the right of the display are used to program the parameters. The third digit from the right, which has a decimal point activated, indicates the parameter number. The other two digits indicate the parameter value. The digit in flashing is the one that can be modified.

Two digits displays:

The two digits of the display are used to program the parameters. The digit of the left, which has a decimal point activated, indicates the parameter number. The digit in flashing is the one that can be modified. With the advance key "*" it can read alternatively the parameter value or parameter number

4.2.1. Enter to modify parameters.

In order to enter the sequence to modify the parameters, the Advance key “*” must be pressed and held for three seconds. After this, the first parameters will be displayed, showing the most significant digit flashing.

There are then two options:

1- Modify the parameter value

By pressing the Advance key “*”, entry is gained to modify the parameter value.

To go back to displaying the parameter number, press “*” again.

To increase the parameter value, press the “+” key. After parameter F it returns to 1.

2- Select another parameter

In order to select another parameter, the parameter number must be made to flash using the “*” key and then the new parameter may be selected using the “+” key.

4.2.2. Exit modify parameters.

In order to exit the sequence for modifying parameters, parameter F must be selected. Then press “*”.

4.2.3. Function of each parameter.

4.2.3.1. Parameter 1: Display address.

It configures the display address in the network. This value is used in RS-232 and RS-485. The address range is between 0 and 99.

4.2.3.2. Parameter 2: Communication protocol and Round function.

It selects the communication protocol. The protocols available are:

Parameter	Details in paragraph
1: Ditel	4.3.1 Code 1: Ditel.
2: ISO 1745	4.3.2 Code 2: ISO 1745.
3: ModBus	4.3.3 Code 3: ModBus.
4: Host-Link Slave from Omron	4.3.4 Code 4: Host-Link Slave of Omron.
5: ASCII	4.3.5 Code 5: ASCII
6: Host-Link Master from Omron	4.3.6 Code 6: Host-Link Master of Omron.
8: S7-200 from Siemens	4.3.7 Code 8. S7-200 from Siemens
9: Delta	4.3.8 Code 9. Delta

The protocol code must be put in the right digit.

The round function permits forcing to 0 the digits at the right of the display. There can be from 0 to 3 digits forced to 0. The value of the Round must be put in the left digit

Examples:

Parameter 2 = 03 ModBus. Round not activated.

Parameter 2 = 15 ASCII. The right digit of the display is 0.

Parameter 2 = 25 ASCII. The 2 right digits of the display are 0.

4.2.3.3. Parameter 3: Transmission baud rate, data bits, parity and stop bits.

The parameters of the serial line are codified in the following table:

Code	Baud Rate	Data bits	Parity	Stop bits
01	4800 Bauds	7 bits	No parity	1
02	9600 Bauds	7 bits	No parity	1
03	19200 Bauds	7 bits	No parity	1
04	4800 Bauds	8 bits	No parity	1
05	9600 Bauds	8 bits	No parity	1
06	19200 Bauds	8 bits	No parity	1
07	4800 Bauds	7 bits	Even	1
08	9600 Bauds	7 bits	Even	1
09	19200 Bauds	7 bits	Even	1
10	4800 Bauds	8 bits	Even	1
11	9600 Bauds	8 bits	Even	1
12	19200 Bauds	8 bits	Even	1
13	4800 Bauds	7 bits	Odd	1
14	9600 Bauds	7 bits	Odd	1
15	19200 Bauds	7 bits	Odd	1
16	4800 Bauds	8 bits	Odd	1
17	9600 Bauds	8 bits	Odd	1
18	19200 Bauds	8 bits	Odd	1
19	4800 Bauds	7 bits	No parity	2
20	9600 Bauds	7 bits	No parity	2
21	19200 Bauds	7 bits	No parity	2
22	4800 Bauds	8 bits	No parity	2
23	9600 Bauds	8 bits	No parity	2
24	19200 Bauds	8 bits	No parity	2
25	4800 Bauds	7 bits	Even	2
26	9600 Bauds	7 bits	Even	2
27	19200 Bauds	7 bits	Even	2
28	4800 Bauds	8 bits	Even	2
29	9600 Bauds	8 bits	Even	2
30	19200 Bauds	8 bits	Even	2
31	4800 Bauds	7 bits	Odd	2
32	9600 Bauds	7 bits	Odd	2
33	19200 Bauds	7 bits	Odd	2
34	4800 Bauds	8 bits	Odd	2
35	9600 Bauds	8 bits	Odd	2
36	19200 Bauds	8 bits	Odd	2

ATTENTION:

If you are using the S7-200 protocol, the baud rate 4800 is not valid. If a code with 4800 bauds is programmed a baud rate of 9600 bauds is set.

4.2.3.4. Parameter 4: Type of serial line.

It selects one of the two types of serial line available.

- Type 1: RS-232 serial line
- Type 2: RS-485 or RS-422 serial line

4.2.3.5. Parameter 5: Time-out reception.

It programs a period of time to wait until receive correct data. The warning is shown once the time programmed is exceeded. Every time new data is received correctly, the time is set to 0. The code "00" (without timing) does not produce any warning.

Code	Time	Code	Time
00	No time	11	1 min.
01	2 s	12	2 min.
02	4 s	13	5 min.
03	6 s	14	10 min.
04	8 s	15	20 min.
05	10 s	16	40 min.
06	14 s	17	1 hour.
07	20 s	18	2 hours.
08	26 s	19	5 hours.
09	30 s	20	10 hours.
10	40 s	21	25 hours.

4.2.3.6. Parameter 6:

This parameter changes its function depending on the protocol the user is working with.

4.2.3.7. Parameter 8:

This parameter changes its function depending on the protocol the user is working with.

4.2.3.8. Parameter 9:

This parameter changes its function depending on the protocol the user is working with.

4.2.3.9. Parameter A:

This parameter changes its function depending on the protocol the user is working with.

4.2.3.10. Parameter B:

Display with colour option. See paragraph 4.4 Colour configuration.

4.2.3.11. Parameter C:

Display with colour option. See paragraph 4.4 Colour configuration.

4.2.3.12. Parameter D:

Display with colour option. See paragraph 4.4 Colour configuration.

4.2.3.13. Parameter E:

Display with colour option. See paragraph 4.4 Colour configuration.

4.2.3.14. Parameter nr, r1, r2, r3:

Display with colour option. See paragraph 4.4 Colour configuration.

4.2.3.15. Parameter F:

Exit modify parameters

Press the key "*" to exit the option modify parameters. Before exiting the parameters are saved.

Press the key "+" until reaching the parameter to be modified to keep on modifying parameters.

4.3. Protocols

In this paragraph, the different protocols will be explained, as well as the programming of the displays through them. The formats of values of the numbers and characters are written in this manual are:

- When telling about a hexadecimal number, this will be followed by an “h”.
- When telling about a decimal number, this will be followed by a “d”.
- When telling about a binary number, this will be followed by a “b”.
- When telling about an ASCII character, this will be explained in the context.

As an example, the X ASCII character can be explained as 58h, 88d or 1011000b, as needed in the moment. Number 15 ASCII can be seen as 31h 35h, 49d 53d or 110001d 110101d.

4.3.1. Code 1: Ditel.

It is the protocol to communicate with Ditel equipment of Kosmos series.

It can be used with RS-232 and RS-485 serial line. It selects the direction of Kosmos equipment between address 0 and 99.

The characteristics of the serial line are: 8 data bits, without parity and 1 stop bit. The baud rate that can be configured are: 4800, 9600 and 19200 bauds.

For more information see the information from Ditel equipment.

Example of configuration for a display in address 03

Display address: 03	Parameter 1	03
Protocol: Ditel	Parameter 2	01
Serial line:9600 Bauds	Parameter 3	02
Serial line type: RS-485	Parameter 4	02
Time-out reception data: 6 seconds	Parameter 5	03

4.3.2. Code 2: ISO 1745.

It is the protocol according to ISO 1745 rule, but applied to communication with Ditel equipment of Kosmos series.

The characteristics of the serial line are: 7 data bits, even parity and one stop bit.

The baud rates able to be configured are: 4800, 9600 and 19200 bauds.

DN-109/119/129/189X display works as a master and Ditel equipment works as a slave.

4.3.2.1. Frame to send

The message sent is the following sequence of characters:

SOH	D	d	C	C	ETX	BCC
01h	High	Low	00h	44h	03h	CRC
01d	Address	Address	00d	68d	03d	

The address bytes must be sent in ASCII format. If the address of the equipment is 15, it must be sent D=31h and d=35h.

The calculation of CRC is done as follows:

OR-exclusive of all the bytes included between STX (not included) and ETX (included) must be carried out.

If the byte obtained is higher or equal to value 20h (32d), this value must be taken as CRC

If the byte obtained is lower than the value 20h (32d), 20h (32d) must be added to obtain CRC.

4.3.2.2. Response from the display

The answering message must be the following sequence of characters:

SOH	D	d	STX	X...X	ETX	BCC
01h	High	Low	02h	Data	03 h	CRC
01d	Address	Address	02d		03d	

The address bytes must be sent in ASCII format. If the address of the equipment is 15, D=31h and d= 35h have to be sent.

The calculation of CRC is done the same way as for the message sent.

Display address: 01	Parameter 1	01
Protocol: ISO 1745	Parameter 2	02
Serial line:9600 Bauds	Parameter 3	02
Serial line type: RS-232	Parameter 4	01
Time-out reception data: 2 seconds	Parameter 5	01

4.3.3. Code 3: ModBus.

It is the protocol according to Modbus specifications mode RTU. This protocol is widely used in the industrial area and it is easily adaptable to several types of instruments.

Protocol Modbus uses the silences in the transmission to indicate the beginnings and endings of the messages. A silence is the time equal or higher than the time required to transmit 3 characters. There is a different time for every baud rate transmission. It is not possible to begin a transmission when another one have just end. It is necessary to wait the time required for a transmission of three characters.

The display always works in slave mode with this protocol. Once a message has just been received with the display address, a message with the results of transmission will be sent.

Both functions 06h and 10h can be used:

Function 06h allows to send a word to the display, so the maximum value the display can show is 65535. This function is useful in displays of 4 digits or less, although it can be used in bigger displays showing values smaller than 65535.

Function 10h can be used in two ways:

Word mode: It allows sending 2 words for the data plus a word for the decimal point position.

ASCII mode: It allows sending words codified in ASCII. This mode allows sending control characters to flash digits.

4.3.3.1. Function 06h

This function allows using integers with or without sign. The address sent defines whether the values are signed or unsigned.

Address 40003	Signed integer: -32767 to +32767
Address 40007	Unsigned Integer: 0 to 65535

Frame to send

The message received must be the following sequence of characters

Addr.	Func.	Register High	Register Low	Value High.	Value Low	High CRC	Low CRC
	06h	00h					

Addr: Display address. Value between 0h and 63h.

Func: Always value 06h.

Register High: Always value 00.

Register Low: 02h (40003) for signed integer. 06h (40007) for unsigned integer.

Value High: Data to display. High byte of the integer.

Value Low: Data to display. Low byte of the integer.

Response message

When the display receives a message sent to it (to its address), it returns a message, which indicates whether it has received it correctly or not

Correct answer.

The response to acknowledge a correct received message is to return the same message.

Incorrect answer. Transmission error.

Addr.	Error	Error Code	Low CRC	High CRC
	86h			

Address: display address. Value between 0h and 63h

Func: Always value 86h

Error code

- 01: Error in the heading from the received message
- 02: Error in the destination register address.
- 05: Error in the number of bytes received.
- 06: Error of CRC in the received bloc

CRC: It is calculated using the same method as in the transmission.

4.3.3.2. Function 10h. Mode Word

This function allows sending two words to the display, so the maximum value the display can show is 4294967295. This function is useful in displays of 9 digits or less, although it can be used in 10 digits displays showing values smaller than 4294967295.

Address 40003

Signed integer: -2147483647 to +214783647

Address 40007

Unsigned Integer: 0 to 4294967295.

Frame to send

The message received must be the following sequence of characters

Addr.	Func.	Register High	Register Low	Words High	Words Low	Bytes Num.	Value 1	Value 2	Value 3	Low CRC	High CRC
	10h	00h		00h	03h	06h					

Addr: Display address. Value between 0h and 63h.

Func: Always value 10h.

Register High: Always value 00h.

Register Low: 02h (40003) for signed integer. 06h (40007) for unsigned integer.

Words High: Always 00h.

Words Low: Always 03h.

Bytes Num: Always 06h

Value 1, 2: Data to display. Hexadecimal format.

Value 3: Decimal point position. It allows activating the decimal point of the sent data. See the values to send depending on the position in the following table.

01h	00000000.0
02h	0000000.00
04h	000000.000
08h	00000.0000
10h	0000.00000
11h	000.000000
12h	00.0000000
14h	0.00000000

Response from the display

When the display receives a message sent to it (to its address), it returns a message, which indicates whether it has received it correctly or not

Correct answer.

The message received must be the following sequence of characters

Addr.	Func.	Register High	Register Low	Words High	Words Low	Low CRC	High CRC
	10h	00h		00h	03h		

Addr: Display address. Value between 0h and 63h.

Func: Always value 10h.

Register High: Always value 00h.

Register Low: 02h (40003) for signed integer. 06h (40007) for unsigned integer.

Words High: Always 00h.

Words Low: Always 03h.

CRC: It is calculated using the same method as in the transmission.

Incorrect answer. Transmission error.

Addr.	Error	Error Code	Low CRC	High CRC
	90h			

Address: display address. Value between 0 and 63

Func: Always value 90h.

Error code

- 01: Error in the heading from the received message
- 02: Error in the destination register address.
- 05: Error in the number of bytes received.
- 06: Error of CRC in the received bloc

CRC: It is calculated using the same method as in the transmission.

4.3.3.3. Function 10h. Mode ASCII

ASCII mode allows displaying any value, independently of the digits of the display. It allows the user to send some alphanumerical characters representing the 7 segments and activate segments not codified.

Frame to send

The message received from the display must be the following sequence of characters

Addr.	Func.	Cont	Posi	Words High	Words Low	Bytes num.	Value	Low CRC	High CRC
	10h	01h	00h						

Addr: Display address. Value between 0h and 63h.

Func: Always value 10h

Cont: Always value 01h

Posi: Always value 00h

Words High: it is the high weight of the number of words (2 bytes) from the value field

Words Low: it is the low weight of the number of words (2 bytes) from the value field

Bytes num.: it is the number of bytes from the value field. It is twice the number of words.

Value: Data to display. They must be in hexadecimal format and they must be an even number of characters. Value 0 can be used to adjust the number of characters to an even number.

The first character sent is set on the right of the display.

Response from the display

When the display receives a message sent to it (to its address), it returns a message, which indicates whether it has received it correctly or not

Correct answer.

Addr.	Func.	Cont	Posi	Words High	Words Low	Low CRC	High CRC
	10h	01h	00h				

Address: Display address. Value between 0 and 63

Func: Always value 01h.

Cont: Always value 01h.

Posi: Always value 00h.

Words High: It is the same value as the one received.

Words Low: It is the same value as the one received.

CRC: It is calculated using the same method as in the transmission.

Incorrect answer. Transmission error.

Addr.	Error	Error Code	Low CRC	High CRC
	90h			

Address: display address. Value between 0h and 63h.

Func: Always value 90h.

Error code

- 01: Error in the heading from the received message
- 02: Error of CRC in the received bloc
- 05: Error in the number of bytes received.

CRC: It is calculated using the same method as in the transmission.

4.3.3.4. Valid characters.

The characters allowed are:

Character	0	1	2	3	4	5	6	7	8	9	A	b
HEXA	30h	31h	32h	33h	34h	35h	36h	37h	38h	39h	41h	42h
DEC	48d	49d	50d	51d	52d	53d	54d	55d	56d	57d	65d	66d

Character	C	c	d	E	F	H	h	i	J	L	n	o
HEXA	43h	63h	64h	45h	46h	48h	68h	69h	4Ah	4Ch	6Eh	6Fh
DEC	67d	99d	100d	69d	70d	72d	104d	105d	74d	76d	110d	111d

Character	P	r	U	u	,	.	-	_	'	-	
HEXA	50h	72h	55h	75h	20h	2Ch	2Eh	2Dh	16h	27h	28h
DEC	80d	114d	85d	117d	32d	44d	46d	45d	22d	39d	40d

Other special orders can be sent:

Beginning and ending of **flashing** code are used to set in flashing a character, several characters or all characters. Beginning of flashing code must be set before the first character in flashing and the end of flashing code must be set after the last character in flashing

- 08h: Begin of flashing characters
- 09h: End of flashing characters

Colour Option: In the displays with the option colour, the colour may be modified using a command. Character X (58h) followed by the colour code force the display to use that colour. While using colour control by code, parameters B and D must be equal to 0 and colour control depending on displayed value must not be used. Colour is only applicable in function 10h ASCII.

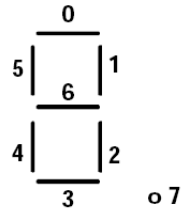
The colour codes are:

- 0 (30h) -> Red colour
- 1 (31h)-> Green colour
- 2 (32h)-> Yellow colour.

7Eh character allows activating directly the segments and the decimal point. It is used to display non-codified symbols.

It is used as follows:

1. Two bytes must be sent for every character to display.
2. The first byte is 7Eh character.
3. All the bits =1 of the second byte activate directly a segment, according to the following distribution.



Example 1. Bits 0, 6 and 3 must activate the three horizontal dashes. Therefore, byte 49h (01001001b) must be sent.

Example 2. Bits 1, 2, 4, 5, and 7 must activate the two horizontal bars and the decimal point. Therefore, byte B6h (10110110) must be sent.

CRC: the calculation of CRC is done from all the characters of the message except from the two ones belonging to CRC. The following process is done to calculate CRC:

1. Value FFFFh must be assigned to CRC register.
2. OR-exclusive must be done between the CRC register and the first byte of the message and assign it to CRC.
3. Shift 1 bit to the right in the register CRC setting to zero MSB and move left bit to the carry bit.
4. If the carry bit is zero, return to 3. If the carry bit is one, do an OR-exclusive of CRC register with value A001h and assign it to CRC
5. Repeat 2 and 3 until completing a total of 8 shifts to process the byte
6. Repeat 2 and 5 for the rest of bytes of the message
7. Set the obtained CRC at the end of the message, so that the low byte is in the first place.

Example 1: Function 06h

Number of digits: 4		
Display address: 01	Parameter 1	01
Protocol: ModBus	Parameter 2	03
Serial line: 9600 Bauds. 8 bits. Even parity. 2 Stop bit	Parameter 3	29
Serial line type: RS-485	Parameter 4	02
Time-out reception data: 10 seconds	Parameter 5	05

Data to display

6	0	4	5
---	---	---	---

Sequence to be sent.

01h	06h	00h	05h	17h	9Dh	E6h	53h
-----	-----	-----	-----	-----	-----	-----	-----

Example 2: Function 10h Word.

Number of digits: 8		
Display address: 01	Parameter 1	01
Protocol: ModBus	Parameter 2	03
Serial line: 9600 Bauds. 8 bits. Even parity. 2 Stop bit	Parameter 3	29
Serial line type: RS-485	Parameter 4	02
Time-out reception data: 10 seconds	Parameter 5	05

Data to display

1	5	8	6	4	2.	7	9
---	---	---	---	---	----	---	---

Sequence to be sent.

01h	10h	00h	02h	00h	03h	06h	00h	F2h	11h	D7h	00h	02h	4Ah	5Ah
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

Example 3: Function 10h ASCII.

Number of digits: 8		
Display address: 10	Parameter 1	10
Protocol: ModBus	Parameter 2	03
Serial line: 9600 Bauds. 8 bits. Even parity. 1 Stop bit	Parameter 3	11
Serial line type: RS-485	Parameter 4	02
Time-out reception data: 10 seconds	Parameter 5	05

Data to display

7	6	5	4	3	2	1	0
---	---	---	---	---	---	---	---

Sequence to be sent.

10h	10h	01h	00h	00h	04h	08h	30h	31h	32h	33h	34h	35h	36h	37h	0Eh	7Eh
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

Example 4: Function 10h ASCII.

Number of digits: 8		
Display address: 01	Parameter 1	01
Protocol: ModBus	Parameter 2	03
Serial line: 9600 Bauds. 8 bits. Even parity. 1 Stop bit	Parameter 3	11
Serial line type: RS-485	Parameter 4	02
Time-out reception data: 10 seconds	Parameter 5	05

Data to display

			-	6	7.	1	0
--	--	--	---	---	----	---	---

Sequence to be sent.

01h	10h	01h	00h	00h	04h	08h	39h	39h	2Ch	37h	36h	2Dh	20h	20h	BBh	B7h
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

Example 5: Function 10h ASCII.

Number of digits: 8		
Display address: 01	Parameter 1	01
Protocol: ModBus	Parameter 2	03
Serial line: 9600 Bauds. 8 bits. Even parity. 1 Stop bit	Parameter 3	11
Serial line type: RS-485	Parameter 4	02
Time-out reception data: 10 seconds	Parameter 5	05

Data to display

			8	9.	5	7	2
--	--	--	---	----	---	---	---

Sequence to be sent.

01h	10h	01h	00h	00h	05h	0Ah	08h	32h	37h	35h	2Ch	39h	38h	20h	20h	09h	65h	4h7
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

4.3.4. Code 4: Host-Link Slave of Omron.

This protocol connects with Omron PLC using Host-link protocol.

5 consecutive DM are used. The first one must be in an address divisible for 100 (DM0000, DM0100, DM0200... DM5400). DMs can be programmed from DM00 to DM9900, a total of 99.

However, it must be taken into account that DM are able to be used in every PLC type.

This DM configuration can be used in displays of a maximum of 12 digits.

The function of every DM is:

- DMxx00: Values corresponding to digits 9 to 12. Digit 12 is the highest weight.
- DMxx01: Values corresponding to digits 5 to 8
- DMxx02: Values corresponding to digits 1 to 4. Digit 1 the lowest weight.

xx corresponds to hundreds and thousands of DM number. This code is programmed in parameter 6.

DMxx00				DMxx01				DMxx02			
12	11	10	9	8	7	6	5	4	3	2	1

DMxx03: Reserved.

DMxx04: Position of the decimal point. In the three lowest weight digits, the decimal point to be activated is codified.

All the bits to 1 activate a point in the display in this DM.

The decimal point is activated on the right of the selected digit.

Characters "A", "B", "C" and "D" are displayed as "A", "b", "C", and "d".

Character E is displayed "-"

Character "F" is displayed as an unlighted digit. Space character.

Host-Link Omron's protocol must be used with RS-422 instead of RS-485.

Example:

Display address: 01	Parameter 1	01
Protocol: Host-Link Omron Slave Protocol	Parameter 2	04
Serial line: 9600 Bauds. 7 bits. No parity. 2 Stop bits	Parameter 3	26
Serial line type: RS-232	Parameter 4	01
Time-out reception data: 20 seconds	Parameter 5	07
Selection on n° of DMx100 Example: DM100	Parameter 6	01

DM0000 = 8542

DM0001 = 7311

DM0002 = 2069

DM0004 = 0004

In a 10 digits display:

4	2	7	3	1	1	2	0.	6	9
---	---	---	---	---	---	---	----	---	---

In a 6 digits display:

1	1	2	0.	6	9
---	---	---	----	---	---

DM0000 = FFFF

DM0001 = FFE4
 DM0002 = 8146
 DM0004 = 0002

In a 6 digits display:

-	4	8	1	4.	6
---	---	---	---	----	---

Display address.

The display address must be equal to address specified in the PLC settings.

4.3.5. Code 5: ASCII

This protocol permits easy communication with any unit with serial line and that can have the protocol configured, as with a computer, a PLC Omron working in RS-232 mode, etc. Another possibility is to connect various displays from the same unit on a RS-485 network.

With this protocol, the display works in slave mode, which is to say the display waits to receive a message and once received, it will show the value as long as it conforms. The screen may be configured in order to be able to adapt to a multitude of protocols that use the ASCII format.

In order to understand how the protocol can be configured, the terms used are described below:

Transmission block: This is formed by all the bytes necessary in order to be able to display a value. For each transmission block correctly received, the display will update itself with a new value. Each block is made up of three parts: The header, the data tablet and the block end.

Block header: This is used to identify the beginning of the block. One can choose between 4 formats or no header.

Data frame: This contains the information that should be displayed. Through parameters 8 and 9, it is possible to select the part of the block that you desire to be displayed.

Block end: This is used to identify the complete delivery of the block. One can choose between 6 types of block ends.

4.3.5.1. Protocol parameters

Some parameters must be taken in account to configure the display

Parameter 6: Header selection.

Code	Header	
00	@ AH AL E D	Host-Link from Omron
01	02h	Value 02h
02	02h AH AL	Value 02h + display address.
03	02h AL AH	Value 02h + display address.
04	No Header	
05	AH AL	Display address.
06	AL AH	Display address.

Where AL is Address low byte and AH is address high byte. For value greater than 06 the block is rejected.

Parameter 7: End of block selection.

Code	End of block	
00	* CR	Host-Link from Omron 2Ah 0Dh.
01	03h	Value 03h
02	CR LF	0Dh 0Ah.
03	LF CR	0Ah 0Dh.
04	CR	0Dh.
05	LF	0Ah.

For value greater than 05 the block is rejected.

Parameter 8: Skip characters.

This permits skipping of characters in the data block in order to be able to select a value within a phrase. An example to help understand the operation would be:

Supposing that we have a weighing unit that, upon ending a cycle, has sent the following phrase through the serial line:

«The weight is 193.8kg». To be able to display the weight, we must extract only the value 193.8 from the text. The way to do this is by SKIPPING the characters in the text (the spaces, periods and commas count as characters). In this case, there are 14. This is the value that should be programmed.

The range of values accepted is from 00 to 99.

Parameter 9: Value position.

Some units, upon transmitting the information through the serial line, first send the lowest digit of weight, while others first send the highest digit of weight. This parameter permits the correct display of the values in adapting itself to all units.

Inverted presentation. Values between 01 and 09: The digit that is in position 0n (01 to 09) of the data tablet is placed in the digit on the right side of the display. The next digits on the screen are to be placed on the left.

Example Data block	1	7	6	3	2	8	4	5	9
---------------------------	---	---	---	---	---	---	---	---	---

Parameter 9: 04										
6 digits display					9	5	4	8	2	3
4 digits display							4	8	2	3

Parameter 9: 02										
6 digits display					4	8	2	3	6	7
4 digits display							2	3	6	7

In these examples, it has been assumed that parameter 8 (skipping characters) was equal to 0, for which the entire data tablet is valid. Depending on the number of digits of the unit (4 and 6 in the example), more or less digits may be displayed, but the digit on the right will always stay the same.

Normal presentation. Values between 11 and 19: In order to obtain the initial digit position, 10 should be subtracted from the parameter value. Digit 1n (1 to 9) of the data is placed in the digit on the right of the display. The preceding digits on the screen will be placed on the left.

Example Data block	1	7	6	3	2	8	4	5	9
---------------------------	---	---	---	---	---	---	---	---	---

Parameter 9: 18									
6 digits display			6	3	2	8	4	5	
4 digits display					2	8	4	5	

Parameter 9: 14									
6 digits display					1	7	6	3	
4 digits display					1	7	6	3	

Parameter 9: 16									
6 digits display			1	7	6	3	2	8	
4 digits display					6	3	2	8	

In these examples, it has been assumed that parameter 8 (skipping characters) was equal to 0, for which the entire data tablet is valid. Depending on the number of digits of the unit (4 and 6 in the example), more or less digits may be displayed, but the digit on the rights will always stay the same.

If Parameter 9 has a value equal to 0 or 10, or is higher than 19, the block is rejected and the received value is not displayed.

Parameter A: Response message

After receiving a transmission block, the display may be programmed so that it sends a response message. The options are:

Code	Response message	
00	No response	No response from the display
01	@ AH AL E D 0 * CR	40h Addr.H Addr.L 45h 44h 30h 2Ah 0Dh
02	BH ACK EB	Bock Header 06h End of block

Example 1: To send a message from a computer

Display address: 08	Parameter 1	08
Protocol: ASCII	Parameter 2	05
Serial line: 9600 Bauds. 8 bits. Even parity. 2 Stop bits	Parameter 3	29
Serial line type: RS-232	Parameter 4	1
Time-out reception data: 6 seconds	Parameter 5	03
Header: 02h AH AL	Parameter 6	02
End of block CR (0Dh)	Parameter 7	04
Skip characters: 0	Parameter 8	00
Value position: 7 (Normal presentation)	Parameter 9	17
Response message: No response	Parameter A	00

Data sent:

Example Data block ASCII		0	8		3	5	8	9	6	4	CR
Example Data block hexa	02h	30h	35h	20h	33h	35h	38h	39h	36h	34h	0Dh

Displayed on 4 digits display								8	9	6	4
Displayed on 8 digits display					5	3	8	9	6	4	

Example 2: To send a message from a scale

Display address: 14	Parameter 1	14
Protocol: ASCII	Parameter 2	05
Serial line: 9600 Bauds. 8 bits. Even parity. 2 Stop bits	Parameter 3	29
Serial line type: RS-485	Parameter 4	2
Time-out reception data: 6 seconds	Parameter 5	03
Header: 02h AH AL	Parameter 6	04
End of block CR (0Dh) LF (0Ah)	Parameter 7	00
Skip characters: 6 (Poids)	Parameter 8	06
Value position: 5 (Normal presentation)	Parameter 9	15
Response message: No response	Parameter A	00

Data sent:

Example Data block ASCII	P	O	I	D	S		1	5	,	8	k	g	CR	LF
Example Data block hexa	50h	6Fh	69h	64h	73h	20h	31h	35h	2Ch	38h	6Bh	67h	0Dh	0Ah

Displayed on 4 digits display											1	5.	8
--------------------------------------	--	--	--	--	--	--	--	--	--	--	---	----	---

With parameter 8 = 5, the first 5 characters are skipped in the data tablet. In this example, as it is a block with no header, it corresponds to the first 5 characters of the transmission block.

With parameter 9 = 15, it is indicated that the data will be displayed in the same order in which it was received (normal presentation) and that the first digit on the right of the display will be the character that is in position 5 (15-10) after skipping the characters indicated in parameter

Example 3: To send a message from an Omron PLC using the TXD instruction

Display address: 1	Parameter 1	01
Protocol: ASCII	Parameter 2	05
Serial line: 9600 Bauds. 7 bits. Even parity. 2 Stop bits	Parameter 3	26
Serial line type: RS-232	Parameter 4	01
Time-out reception data: 6 seconds	Parameter 5	03
Header: 02h	Parameter 6	01
End of block: 03h	Parameter 7	01
Skip characters: 0	Parameter 8	00
Value position: 4 (Normal presentation)	Parameter 9	14
Response message: No response	Parameter A	00

In order to display the value of a DM, first ASCII must be converted to, using instruction ASC (86), and then the transmission block is set up and finally sent to the display using instruction TXD (48).

In order to display the value of DM10= 1568, we can use the HR00 to HR05 registries to set up the next screen:

ASCII		1	5	6	8	
HEXA	02h	31h	35h	36h	38h	03h

In this example the HR data area is used but is possible to use any data area.

HR00	HR01	HR02
0231	3536	383

The value assigned to instruction TXD are:

S = HR00, C = #0000, N = #0006

The connection between the PLC Omron and the display is indicated in section Code 4: Omron Host-Link Protocol.

The PLC should have a port that is used, programmed with the Communication Mode equal to RS-232. See PLC Setup from the Syswin programme.

In communicating with a PLC, one can use any type of configuration in the header and ending blocks. It is not necessary to use those in the previous example.

4.3.5.2. Colour option

Displays that have colour option may change the display colour by command. Character X (88 ASCII) is the command that is used to select the colour but the colour code position depends on the value of parameter 9.

If parameter 9 is greater or equal than 11 and lower or equal than 19, the colour code must be set before the command character X (88 ASCII). Example:

Parameter 9 = 12

Set to green colour: 1 X (49 88 ASCII)

If parameter 9 is greater or equal than 01 and lower or equal than 09, the colour code must be set after the command character X (88 ASCII). Example:

Parameter 9 = 03

Set to yellow colour: X 2 (88 50 ASCII)

While using colour control by code, parameters B and D must be equal to 0 and colour control depending on displayed value must not be used.

The colour codes are:

Red Colour = 0	Green Colour = 1	Yellow Colour = 2
----------------	------------------	-------------------

4.3.5.3. Troubleshooting

This protocol is very flexible and therefore has many parameters to configure. If the programmed parameters do not match with the block received, communication is not possible. Some points to check if correct communication is not occurring are specified below.

1- Upon sending a transmission block, the display continues showing dashes.

- Check parameter 1: Display address. The address of the display is only used if the block header is equal to 0, 2 or 3.
- Check parameter 2: Protocol selected.
- Check parameter 3: Characteristics of the serial line.
- Check parameter 4: Type of serial line configured.
- Check parameters 6 and 7: Types of header and ending blocks.
- Check that parameter 9 is > 0 and within the valid margins.

2- Upon sending a transmission block, the display stays blank.

- Parameter 8 could be wrongly configured.
- Parameter 9 could be wrongly configured.

3- Upon sending a transmission block, the digits are displaced.

- Parameter 8 could be wrongly configured.
- Parameter 9 could be wrongly configured.
- Parameter 6 could be wrongly configured. Value 1, 2 or 3 has been programmed and the raster sent does not correspond to the programmed value.

4- Upon sending a transmission block, the value is correctly displayed, but then dashes are immediately displayed.

- Parameter 5 is programmed to a very low value. See 4.2.3.5 Parameter 5: Time-out reception.

4.3.6. Code 6: Host-Link Master of Omron.

This protocol connects with Omron PLC using Host-link protocol and TXD command. The PLC is the master and the display does not respond.

In this protocol only the command TXD (or equivalent) is used from the PLC. The operation of this protocol is similar to Code 4. The differences are:

	Code 4	Code 6
Register type	DM	DM, HR, IR, LR
Register address	Multiple of 100	Any address
Register name	5	5
Decimal point, negative sign, ASCII characters	Yes	Yes

Data to be displayed must be set in 5 consecutive registers (DM, HR, etc.) considering that rightmost display digit is the most significant digit in the register. (Inverted order)

This register configuration must be used in displays up to 12 digits.

The meaning of each register is:

In this example we used the register HR0037

HR0037: Values for digits 9 to 12. The 12 position is the most significant digit.

HR0038: Values for digits 5 to 8.

HR0039: Values for digits 1 to 4. The 1 position is the less significant digit.

HR0037				HR0038				HR0039			
12	11	10	9	8	7	6	5	4	3	2	1

HR0040: Reserved. Do not use.

HR0041: Position of the decimal point. The three less significant digits are used to codify the decimal point. Each one of the set bits in this register activate a point in the display.

The decimal point is set to the right of the digit.

Example 1: Display the content of HR0037, HR0038 and HR0039

Number of digits: 6		
Display address: 3	Parameter 1	03
Protocol: Omron Host-Link Master	Parameter 2	06
Serial line: 9600 Bauds. 7 bits. Even parity. 2 Stop bits	Parameter 3	26
Serial line type: RS-485	Parameter 4	02
Time-out reception data: 6 seconds	Parameter 5	03

PLC Values. Because of a 6 digit display is used in this example, the value of HR0037 is not significant.

HR0037				HR0038				HR0039				HR0040				HR0041			
x	x	x	x	x	x	9	2	8	3	7	5	x	x	x	x	x	0	0	2

x = Not significant in this example.

Value displayed

9	2	8	3	7.	5
---	---	---	---	----	---

Host-Link Omron's protocol must be used with RS-422 instead of RS-485.

4.3.7. Code 8. S7-200 from Siemens

This protocol connects with Siemens PLC S7-200. Using this protocol the display always is master in the PPI network.

4.3.7.1. Parameters

The function of each parameter is:

Display address in PPI network	Parameter 1	>2
Protocol: S7-200	Parameter 2	08
Baud rate. See 4.2.3.3	Parameter 3	11 or 12
Serial line type: RS-485	Parameter 4	02
Time-out reception data: See 4.2.3.5	Parameter 5	00 to 21
Slave address in PPI network	Parameter 6	00 to 15
Low byte data address	Parameter 7	00 to 99
High byte data address	Parameter 8	00 to 99

Parameter 1: Display address in PPI network

In parameter 1 the display address into PPI network must be codified. The address range must be between 0 and 99, but all equipment must have a different address. A value greater than 2 is strongly recommended because values 0, 1 and 2 usually are used.

Parameter 2: Protocol

Must be 8.

Parameter 3: Baud rate.

For 9600 bauds codify 11. For 19200 Bauds codify 12.

Parameter 4: Serial line type

Must be 2.

Parameter 5: Time-out reception data.

See paragraph 4.2.3.5 Parameter 5: Time-out reception.

Parameter 6: Slave address into PPI network.

Usually the PLC has address 2 but any value between 00 and 15 is valid.

Parameters 7 and 8: Register data address into the PLC.

Only the V area may be used. The display will read 12 consecutive bytes beginning at the address indicated in parameters 7 and 8.

The 12 digits will be shown as:

n+0	n+1	n+2	n+3	n+4	n+5	n+6	n+7	n+8	n+9	n+10	n+11
						↓	↓	↓	↓	↓	↓
						1	2	3	4	5	6

The DTA function converts a double integer to ASCII, leaving the result in 12 bytes format and the less significant digit in n+11.

Examples to explain how to program parameters 7 and 8.

Variable VB6. Program Parameter 7 = 06 and Parameter 8 = 00.

Variable VB28. Program Parameter 7 = 28 and Parameter 8 = 00.

Variable VB142. Program Parameter 7 = 42 and Parameter 8 = 01.

Variable VB6744. Program Parameter 7 = 44 and Parameter 8 = 67.

```
//
// PROGRAM FOR TESTING TRANSMISSION BETWEEN
// A DISPLAY DN109/DN119/DN129 AND PLC S7-200
//
NETWORK 1 //Reset counters
//
//Setting of input 0.1 reset counters.
LD I0.1
MOVD +0, VD0
MOVD +0, VD140

NETWORK 2 //Increment the value of register 0
//While input 0.0 is set register 0 increments each second.
LD I0.0
A SM0.5
EU
INCD VD0

NETWORK 3 //Decrement the value of register 140
//While input 0.0 is set register 140 decrements each second
LD I0.0
A SM0.5
EU
DECD VD140

NETWORK 4 //Converts to strings the value of register 0
// into register VB10 without decimals,
// into register VB1200 with one decimal
// into register VB2000 with two decimal.
LD SM0.0
DTA VD0, VB10, 16#00
DTA VD0, VB1200, 16#01
DTA VD0, VB2000, 16#02

NETWORK 5 //Converts to string the value of register 140
// into register VB30 without decimals,
// into register VB250 with one decimal
// into register VB830 with two decimals.
DTA VD140, VB30, 16#00
DTA VD140, VB250, 16#01
DTA VD140, VB830, 16#02
```

The above program is only an example program. See the next short comment:

Input 0.0 controls the variables VD0 and VD140. If input 0.0 is ON the variable increments and VD140 decrements each second. (SM0.5).

Input 0.1 reset VD0 and VD140.

Each scan (SM0.0) the variables VD0 and VD140 are converted to ASCII with three different formats. Modifying the display parameters 7 and 8 is possible to display the 6 values.

Note: The value of VD140 is negative because the value decrements from 0.

Every time you change from protocol Siemens S7-200 to a different one, the display resets as does at initial reset. See 4.1 "Initial reset."

4.3.8. Code 9. Delta

With this protocol is easy to communicate with counters with the Delta protocol and serial line option. Only is possible to use the serial line RS-485.

With this protocol the display is always a master.

4.3.8.1. Protocol parameters

Parameter 6: Counter address.

Parameter 7: Line number.

See Delta manual.

Parameter 8: Decimal point position.

See the following table:

Value	Decimal Point
00	0
01	0.0
02	0.00
03	0.000
04	0.0000
05	000.00.0

4.3.8.2. Transmission block sent

	STX	AH	AL	LH	LL	ETX
HEXA	02h	Counter		Line		03h

STX: Header. Code 02h.

AH: Counter address high. Value in ASCII.

AL: Counter address low. Value in ASCII.

LH: Line number high. Value in ASCII.

LL: Line number low. Value in ASCII.

ETX: End of block. Code 03h.

4.3.8.3. Response message

Transmission block received

	STX	AH	AL	LH	LL	M	-	XXXXX	ETX	CR
HEXA	02h	Counter		Line		Mode	Sign	Data	03h	0D

STX: Header. Code 02h

AH: Counter address high. Value in ASCII.

AL: Counter address low. Value in ASCII.

LH: Line number high. Value in ASCII.

LL: Line number low. Value in ASCII.

M: Counter state. Not used in the display.

- : Sign of the data. This is sent only if the values is <0. Code 2Dh.

Data: Data sent in ASCII with maximum number of digits; excepting in the negative numbers, where the high Datos pedidos en código ASCII con el máximo número de dígitos, excepto en los números negativos en los que el peso alto se sustituye por el signo.

ETX: End of block. Code 03h.

Example:

Protocol: Delta	Parameter 2	09
Baud rate. 4800 Bauds, 7 bits, Even Parity, 1 stop bit	Parameter 3	07
Serial line type: RS-485	Parameter 4	2
Time-out reception data: 6 seconds	Parameter 5	03
Counter Address	Parameter 6	02
Line: Main counter	Parameter 7	01
Decimal point: 00000.0	Parameter 8	01

4.4. Colour configuration

The colour option allows you to modify automatically the display colour according to the present value. The possible colours are: Red, Green and Yellow.

In order to be able to manage the colour 2 internal bits are used, they change depending on display value. Eight parameters are needed to set up the levels. Four parameters are used to define the activation form and the activation level. The other four allow defining the colour according to a combination of the 2 internal bits.

4.4.1. Parameters to define the internal bit r1.

To set up the internal bit **r1** parameters **B** and **C** are used.

Parameter B is used to set up the activation form and delay or hysteresis.

Parameter C is used to set up the trigger level. The most significant digit allow setting up a negative value.

Parameter B			
Left Digit	Control bit	Right Digit	Set/Reset
0	ON if Value > Parameter C	0	No delay / No hysteresis
1	ON if Value < Parameter C	1	Delay 1s
2	Always OFF	2	Delay 2s
		3	Delay 4s
		4	Delay 6s
		5	Delay 10s
		6	Hysteresis = 2
		7	Hysteresis = 4
		8	Hysteresis = 8
		9	Hysteresis = 12

4.4.2. Parameters to define the internal bit r2.

To set up the internal bit **r2** parameters **D** and **E** are used.





Parameter D is used to set up the activation form and delay or hysteresis.

Parameter E is used to set up the trigger level. The most significant digit allow setting up a negative value.

Parameter D			
Left Digit	Control bit	Right Digit	Set/Reset
0	ON if Value > Parameter E	0	No delay / No hysteresis
1	ON if Value < Parameter E	1	Delay 1s
2	Always OFF	2	Delay 2s
		3	Delay 4s
		4	Delay 6s
		5	Delay 10s
		6	Hysteresis = 2
		7	Hysteresis = 4
		8	Hysteresis = 8
		9	Hysteresis = 12

4.4.3. Parameters to define the colour.

To define the colour the 2 internal bits (**r1** and **r2**) are used.
The following parameters are used to define colours.

	Colour if internal bits are OFF. To change the colour press * key. Upon pressing + the next parameter is shown.
	Colour if internal bit r1 is ON. To change the colour press * key. Upon pressing + the next parameter is shown.
	Colour if internal bit r2 is ON. To change the colour press * key. Upon pressing + the next parameter is shown.
	Colour if internal bits r1 and r2 are ON. To change the colour press * key. Upon pressing + the next parameter is shown.

4.4.4. Work with only one colour.

To work always with only one colour set up the following parameters:

Parameter	Value
B	20
C	0
D	20
E	0
nr	colour
r1	colour
r2	colour
r3	colour

Parameters **C** and **E** may have any value.

Parameters **nr**, **r1**, **r2** and **r3** should have the same colour.

Independently of work colour, the parameters set up always uses RED colour.

Revision history

Revision N (March 2013).

Updated introduction in 4.4.

Revision O (September 2013).

Updated dimensions and weight of DN-109/3. Paragraphs 2.2.1 and 2.3.1.

Revision P (October 2013)

Updated electrical characteristics of the 24VDC power. Paragraphs 2.1 and 3.1.
Corrected paragraphs 4.3.3.4 and 4.3.5.2

Revision Q (May 2014)

Statement of conformity modification.

STATEMENT OF CONFORMITY



Tetralec Electronica Industrial S.L.
c/ Severo Ochoa, 80
Polígono Industrial Font del Radium
08403 Granollers

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

Model : DN-109X in all versions.
Model : DN-119X in all versions.
Model : DN-129X in all versions.
Model : DN-189X in all versions.

We declare under our sole responsibility that the aforementioned product complies with the following European directives:

Directive: LVD 2006/95/CEE Low Voltage Directive.
Standard UNE-EN61010-1 Security in electric equipment.

Directive: EMC 2014/30 UE Electromagnetic Compatibility
Standard UNE-EN 61000-6-4 Generic Emission Standard. Industrial environment.
Standard UNE-EN 61000-6-2 Generic Immunity Standard. Industrial environment.
Directive 2011/65/CE: Restriction of the use of certain hazardous substances in electrical and electronic equipment

Granollers, 29th January 2014