Digital signal converter

DSEUROPE

INSTRUCTION MANUAL

VERSION 0.05 – 22/05/2002

DSENET protocol

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REVISION OF DOCUMENTS AND CORRESPONDENCE		
Product Firmware version	**PC based software version**	**Manual version**
V1.00	V. 3.0	V 0.0 Rev. 0
V1.01	V. 3.0	V 0.0 Rev. 1
V1.01	V. 3.0	V 0.0 Rev. 2
V1.02	V. 3.0	V 0.0 Rev. 3
V1.02	V. 3.0	V 0.0 Rev. 4
V1.02	V. 3.0	V 0.0 Rev. 5

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1 CE DECLARATION OF CONFORMITY

Applied Council's directives:	89/336/CEE modified by directives 92/31/CEE, 93/68/CEE
Conformity to Standards:	**EMC**: EN 50081-2: 1994 - Emissions, General Norm EN 55011 EN 50082-2: 1995 - Susceptibility, General Norm ENV 50140 ENV 50141 EN 61000-3-2 EN 61000-3-3 EN 61000-4-4 EN 61000-4-5 EN 61000-4-2 EN 61000-4-8 ENV 50204 EN 55014-1
Manufacturer:	DS Europe srl
Address:	via F. Russoli, 6 Milan (Italy)
Equipment type:	Digital transmitter for load cells
Model:	Digital transmitter for load cells
Year of registered mark:	2001

The equipment has been tested in the typical installation configuration, as described by the instruction manual of the Product.

DS Europe srl certify that the above defined equipment meets the requirements of above mentioned directives.

Milan, September 12th, 2001

DS Europe srl
Technical Dept.

2 PRODUCTS DESCRIBED BY THIS MANUAL

This manual describes the use of the digital signal conditioner produced by DS Europe and installed in the following products manufactured by DS Europe srl:

- Load cells
- Pressure transducers
- 689 stand alone digital conditioner

The manual will provide information concerning the digital conditioner, the electrical connections to the products, the supplied software utility and the used protocol (DSEnet).

3 GETTING STARTED

For a proper use of the supplied material we suggest:

1. read carefully the manual for correct electrical connections;
2. connect the transducer to a personal computer and power it on;
3. power on the computer and install the supplied software utility;
4. run the *Digital utility* selecting "Start → Programs → Digital utility→ Digital utility" from the START button
5. The program will begin to search the connected transducer in order to establish a communication
   → You are ready for Your first measurements!

4 ELECTRICAL CONNECTIONS

Note: RS485 output is obtained by connecting together TXD – with RXD – and TXD + with RXD +. RS485 line has to be terminated using a 500 Ohm resistor connected on the last transducer installed on the line.

4.1 LOAD CELL

CONDUCTOR COLOR	ELECTRICAL CONNECTION	CAN Output
RED	+ POWER SUPPLY (from 6 to 28 Vdc)	+ Power
BLACK	- POWER SUPPLY	- Power
VIOLET	RS 422 TXD +	
GREEN	RS 422 TXD -	
BLUE	RS 422 RXD +	CAN_L
BROWN	RS 422 RXD -	CAN_H
WHITE	+ ANALOG OUTPUT 0÷5V (Optional)	+ Analog Out
YELLOW	- ANALOG OUTPUT	- Analog Out

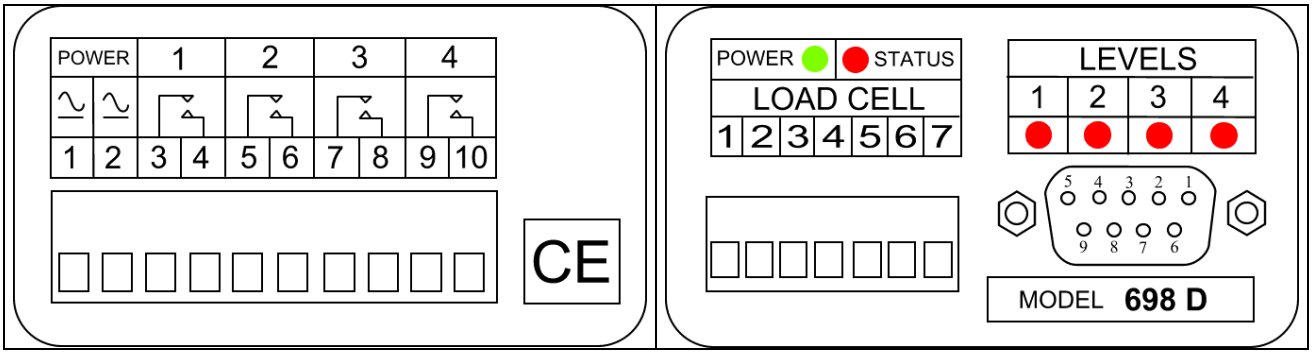
4.2 PRESSURE TRANSDUCER LP668

PIN CONNECTOR	ELECTRICAL CONNECTION	CAN Output
1	+ POWER SUPPLY (from 6 to 28 Vdc)	+ Power
2	COMMON (Power Supply and Analog output)	Common
3	RS 422 TXD +	CAN_H
4	RS 422 TXD -	CAN_L
5	RS 422 RXD +	
6	RS 422 RXD -	
7	+ ANALOG OUTPUT 0÷5V (Optional)	+ Analog Out

4.3 698 DIGITAL CONDITIONER

4.3.1 REAR PANEL

4.3.2 FRONT PANEL



Front Panel connections

Terminal	*Description*		*DS Europe transducer*
1	Earth connection		
2	Transducer's power supply -		Black
3	Transducer's power supply + 5V		Red
4	Input signal +	**From 5 to 80 mV differential**	White
5	Input signal -	(*power supply from 698*)	Green
6	Analog output ground		
7	Analog output 0÷5V (Optional)		

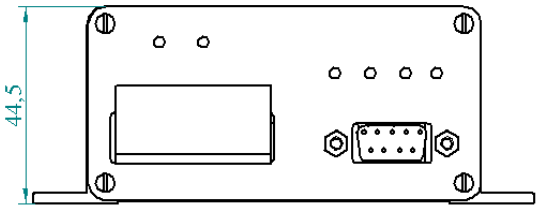
DB-9 Male

Pin	*Description*	
1	RS 422 + RXD	CAN_L
6	RS 422 - RXD	CAN_H
2	RS 422 - TXD	-
7	RS 422 + TXD	-
8	Digital ground	
3	+ 5 VDC	
9	INPUT CONTATC 1 (EXT. +24 V) NO FUNTION	
4	INPUT CONTATC 2 (EXT. +24 V) ZERO FUNTION	
5	GROUND EXTERNAL POWER SUPPLY	

NOTE: for more information to input contacts see section 9.

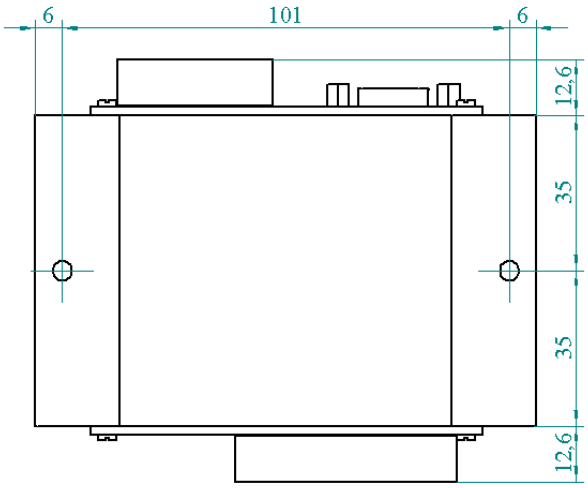
Rear Panel connections

Terminal	*Description*	
1	698 power supply	from 6 to 28 Vdc, polarity free or from 8 to 35 Vac (50/60Hz)
2	698 power supply	
3	Relay contacts 1	
4		
5	Relay contacts 2	
6		
7	Relay contacts 3	
8		
9	Relay contacts 4	
10		



698 dimensions in mm.

In this drawings 698 is mounted with bottom fixing flanges.
Fixing can be reversed so to obtain fix the unit from the top.



5 SOFTWARE GENERAL FEATURES

5.1 INTRODUCTION

This program has been studied in order to calibrate and manage digital measuring systems, like Load Cell, LP 660 pressure transducers, 698 digital conditioners.
Computer Digital utility is based on a user-friendly interface that allows connection by a computer with the possibility to perform easy setup, calibration of the measuring system and measurements.

This program has the sole purpose to ease the User in the understanding of the product and its use. There is no intention to complete all the possible uses or functions that can be obtained by the transducer and it cannot be used to meter transducer's performances in respect of what declared by the manufacturer.

5.2 MINIMUM COMPUTER SYSTEM REQUIREMENTS

- PC 486 or better (desktop or notebook) with 3,5" floppy disk driver.
- 2 Mbytes hard disk free space minimum.
- 4 Mbytes RAM minimum.
- RS 422 port for connection to the display unit (COM port from 1 to 6).
- VGA 256 colours card or better with display resolution of 640x480 minimum.
- OS Windows© 95/98 (NT to be tested).
- Adobe Acrobat reader has to be installed on the computer in order to view the pdf version of this manual (version 3.0 or later).

The setup utility is Y2K compliant.

6 SOFTWARE INSTALLATION

Software utility is supplied with two 3,5" installation disks.
Insert disk number 1 and run file **a:\setup.exe** (supposing that Your floppy disk driver is named "a"), then follow the software instructions.
Setup program creates a program directory and a program group, containing the program and the uninstall utility.
A PDF copy of this manual, in its latest revision, (Adobe® Acrobat® reader is required in order to view this document) can be found in the program's directory.

7 SOFTWARE DESCRIPTION

7.1 FIRST PROGRAM EXECUTION

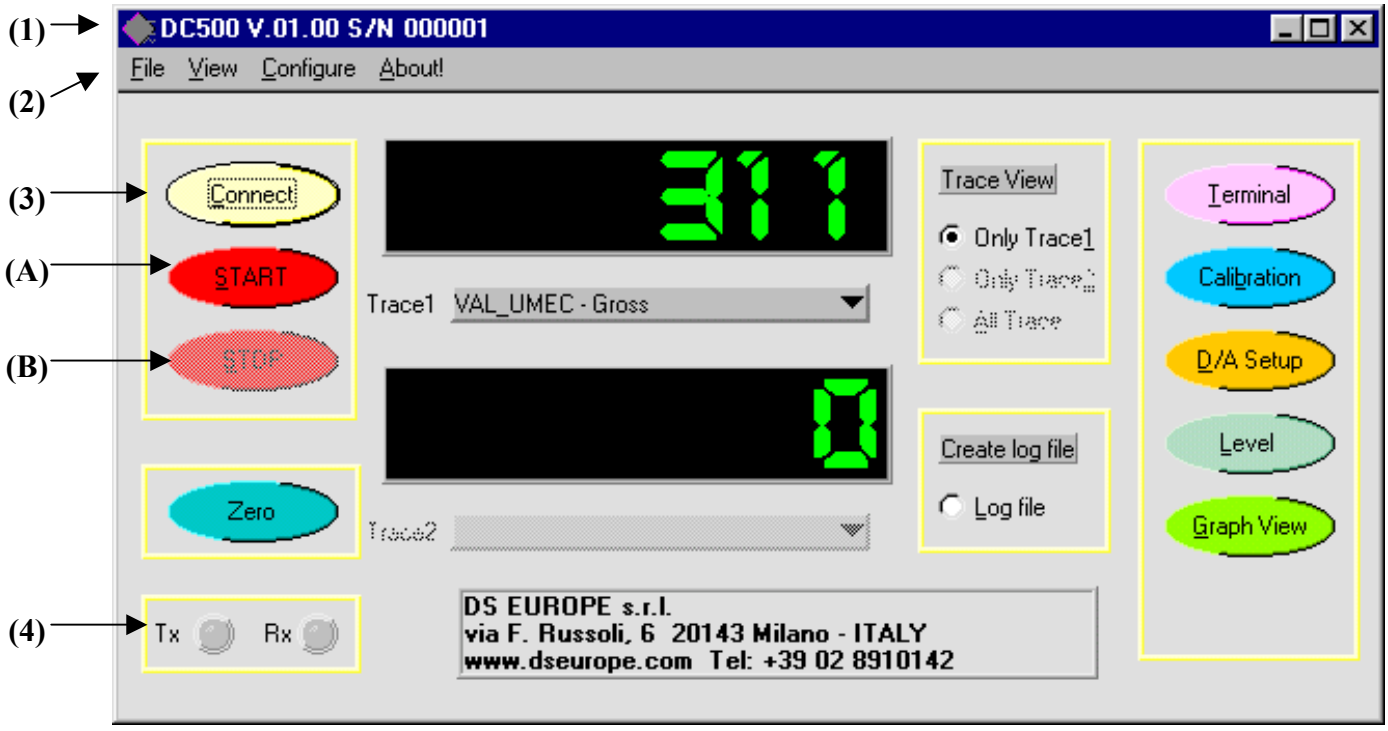
Before running the *software Digital utility* for the first time, connect the measuring system to the RS232 port of the computer, using a line converter, and power all the measuring system.

A suitable line converter RS422/RS485 to RS 232, like the one produced by DS Europe, should convert automatically the lines without the need to use CTS/RTS serial lines.

At the first run, the software scans the available serial interfaces on the computer and tries to connect to the unit.
To run the *Digital utility,* with the mouse select "Start → Programs → Digital utility→ Digital utility".
When the scan detects a connected measuring system, it stops the scan indicating COM port and baud rate at which communication has been established. If it is needed to perform a new serial scan, it is possible to activate it manually from menu bar "Configure → Serial Scan".

7.2 MAIN WINDOW

The main window is described as follows:



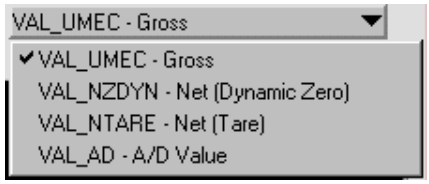
Title bar (1)*:* when *Digital utility* connects successfully with system, it indicates the firmware version and system's serial number.
Menu bar (2): it contains all the commands that are not frequently used. When clicked on a bar element, the corresponding drop down menu will appear.
Command buttons (3): these buttons are used for main functions like connection, calibration, level setup and get parameters.
Communication LED (4)*:* they show communication between system and PC.
Switch Log File: it enables or disables recording of measurements.
Start/Stop buttons: Start or Stop data read from the transducer.

Controls can be buttons, ring selections or menu actions and their status may be:

- *Active*: they are highlighted and can be selected by means of the mouse pointer (A).
- *Not active* : they are shown but are shadowed or greyed and cannot be selected (B).

Window actions: to activate a function, use the mouse in order to move the cursor and click on the desired element, if active. Actions can be activated also with shortcuts, using a combination of keyboard keys. In example "Alt+F" will activate the "File" drop down menu.

Ring selections: it is used to select between fixed alternatives. The user can see the available alternatives by clicking on the ring selection with the mouse. If this control is not modified, it shows the current active selection.



NOTE: on the Digital utility we used a double naming convention with reference to the DSEnet protocol. The purpose is to highlight the use of the different parameters in order to perform measurement or calibration tasks.
The labels will show, in example:
VAL_UMEC – Gross → Gross measurement function in engineering units

1. VAL_UMEC = reference symbol of the parameter used to read the gross measurement (see DSEnet protocol programmer's reference)
2. Gross = measurement function explicit name

7.3 CONNECT BUTTON

By pressing *Connect button,* the program opens the communication between the computer and the transducer.
Connection parameters (com port, baud rate and transducer's address) will be default ones (COM1 port, Baud rate=57600, Address=0) or the last one that were used for a successful connection to the transducer.
During this operation, software will query the transducer for:

- firmware release and serial number and will show on the Title bar the results, if any connection is established.
- Transducer's working parameters to be used to understand the type of transducer connected. This will enable commands and functions specific for the detected type of transducer.

When successful connection to a remote system has been achieved, the program will activate/show all the greyed buttons/functions that can be used.
If program is not able to connect with a remote unit, it will show an error message. In this case, check power supply to the transducer, connections between transducer, line converter (RS422/RS485 to RS 232) and computer. Perform a *serial scan* to find out new correct connection parameters (Configure→Serial scan).

7.4 START/STOP BUTTONS

Start button activates a continuous request of measurement from the transducer. This measurements will be shown on the topmost display. The measurement function is selected by the corresponding trace ring (i.e. press Trace1 ring to see available measurement functions).
Measurement will be displayed accordingly to the chosen measurement function, with the resolution set during calibration.
If any decimal point applies, please adjust the format of the display with View →Decimal Point.
Stop button stops the continuous request of measurement. Please note that the transducer will continue to measure independently from what it is asked to display from the Digital utility.

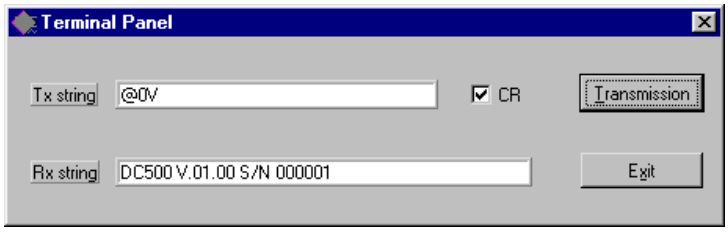
7.5 ZERO BUTTON

By pressing *Zero button,* the Digital utility sends to the transducer the request to perform a dynamic zero on the measurement. This command can be used independently from the fact that START button has been pressed. The effect of such dynamic zeroing is shown selecting the Net (Dynamic Zero) measurement. Please note that such zeroing will be lost if the transducer will be powered-off or if a software reset is performed (during calibration).
Zeroing of the measurement is also activated by:

- ZDYN Software command T0301 (see chapter 11 for protocol details)
- Digital input with closing contact (see paragraph 9.1)

Note that only VAL_NZDYN measurement will reflect zeroing (analog output, if installed, will comply as VAL_NZDYN behaviour).

7.6 TERMINAL BUTTON



Terminal button shows a terminal that allows User to send commands to the remote system, using the protocol structure. It shows also transducer's answers on Rx string field.

If this command is activated while a measurement is performed, the measurement is stopped. By pressing *Transmission button* the Tx string is sent to the remote unit.
By default it is selected to add, automatically, a Carriage Return (CR) to the sting to be sent to the remote system. This option can be disabled.

7.7 CALIBRATION BUTTON

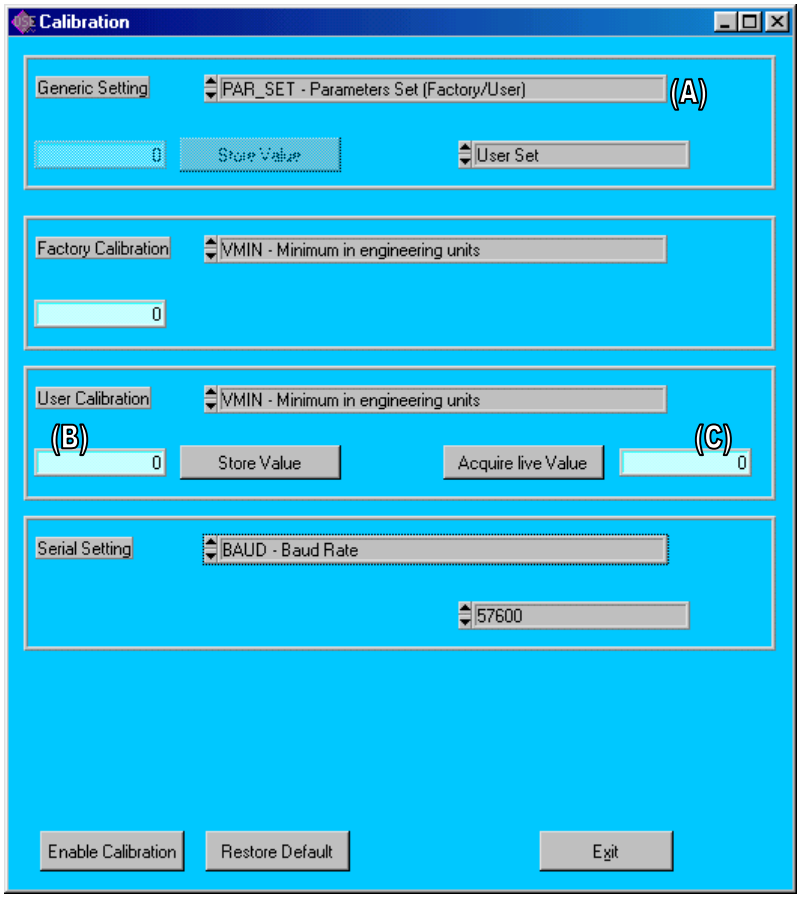
This command stops the measurement and shows a window with several frames, each of them allows the User to select/set specific parameters.

The User can select the parameter he wish to show/modify on the upper side of each frame; the program will show the actual value of the parameter on the lower side of the same frame.

Ring controls (A) and data field are used to show or modify the various parameters.

(B) input fields are used to enter values to be stored by the system using the *Store Value button*.

(C) indicators are used to display the value measured using the *Acquire live Value* button.



Generic Setting	
PAR_SET - Parameters Set (Factory/User)	Factory Set: transducer will convert measurement using Factory's calibration User Set: transducer will convert measurement using User's calibration
AD_SPEED - A/D Output Frequency	From 7,5 to 960 Hz
C_RESET - Reset	It performs a software reset
VERSION - Firmware version	It shows the firmware version
PRODUCER - Producer	It shows producer's name
PRODUCT - Product	It shows product name
ENAZERO - Autozero enable	It enables the autozero function (0 = disabled, 1 = enabled). Autozeroing affects Net measurement (VAL_NZDYN) and is computed from absolute value of VAL_NTARE measurements.
TAUTOZERO - Autozero time window (1/10 s)	If load variation remains within RIPPLE value, for at least this time (in tenth of seconds), autozeroing is performed.
MAXVZERO - Autozero load window	Reference value of load for autozeroing function.
RIPPLE	Maximum measurement variation where autozeroing is allowed
Factory Calibration These settings cannot be modified by the User and are displayed only for consulting	
VMIN – Minimum in engineering units	Minimum reference used to convert the A/D measurements in the chosen engineering units.
VMAX - Maximum in engineering units	Maximum reference used to convert the A/D measurements in the chosen engineering units.
MIN – Minimum A/D value	VMIN corresponding A/D value.
MAX – Maximum A/D value	VMAX corresponding A/D value.
TARE – Tare in engineering units	Tare value, if any.
User Calibration	
VMIN – Minimum in engineering units	Allows to enter, in the corresponding data field, the minimum reference used to convert the A/D measurements in the chosen engineering units. Use *Store Value button* to transfer and store the data on the transducer.
VMAX - Maximum in engineering units	Allows to enter, in the corresponding data field, the maximum reference used to convert the A/D measurements in the chosen engineering units. Use *Store Value button* to transfer and store the data on the transducer.
MIN – Minimum A/D value	VMIN corresponding A/D value. This value can be acquired from live measurement, using the *Set Param button* or set by indicating the known A/D value on the data input field and pressing the *Store Value button*.
MAX – Maximum A/D value	VMAX corresponding A/D value. This value can be acquired from live measurement, using the *Set Param button* or set by indicating the known A/D value on the data input field and pressing the *Store Value button*.
TARE – Tare in engineering units	It is possible to cancel a tare applied to the transducer during system setup. The tare can be set by indicating the known value on the data input field and pressing the *Store Value button*.

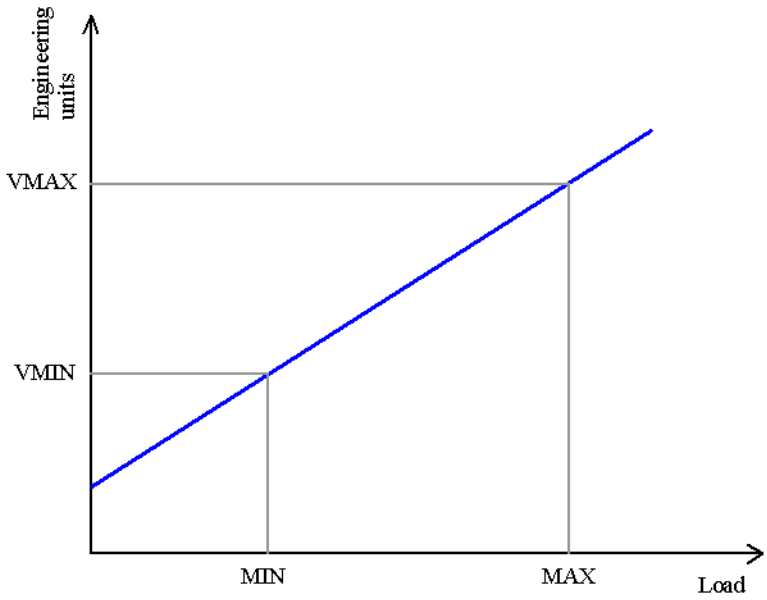
ZDYN - Dynamic Zero in engineering units	Allows to enter, in the corresponding data field, the zero reference used to calculate the Net measurement (VAL_NZDYN). Use *Store Value button* to transfer and store the data on the transducer.
Serial Setting	
BAUD – Baud Rate	From 1200 to 57600 baud
ADDRESS - Address	A character from 0 to 9 and from A to Z (uppercase)

Calibration hints

It is preferable to perform calibration of the system after a regular warm up of the electronics and of the transducer. For measurement systems this is a good practice in order to obtain good results.

IMPORTANT: before performing a new User calibration set AD_SPEED to 7,5 Hz so to get best results. After calibration return to the desired AD_SPEED.

User's calibration is a feature that allows the User to define a system's calibration specific for its needs. This can be useful if the measurement has to be performed with the conversion to a measurement unit, or a resolution, different from the ones set at Factory.



The system will supply measurement data with User's engineering units, if it can match the A/D value of two known points with the corresponding value in the desired engineering units.
This means that the system will match the MIN A/D value to the corresponding VMIN value and MAX A/D value to VMAX.
Based on the line defined by this matching, all the other measurements will be supplied converted on the desired engineering units.
VMIN and VMAX are referring to gross measurement.

NOTE: when entering the value for VMIN, VMAX, TARE and ZDYN remember that the value must be an integer, considering the desired resolution. Supposing that VMAX is 5 Kg and the desired resolution is of 1g, the value to be entered as VMAX is 5000 (grams).

Store Value button: used to store the data entry field value into the selected parameter.

Acquire live value button: used to store the live measurement of a calibration parameter.

***Enable Calibration button*:** some parameters are protected by a User's password in order to avoid accidental changes. The program will signal to the User that the parameter is protected if any change is performed without unlocking the protection. To unlock the protection press once the *Enable Calibration button*.
By powering down the transducer, or by resetting it, the password unlock is lost.

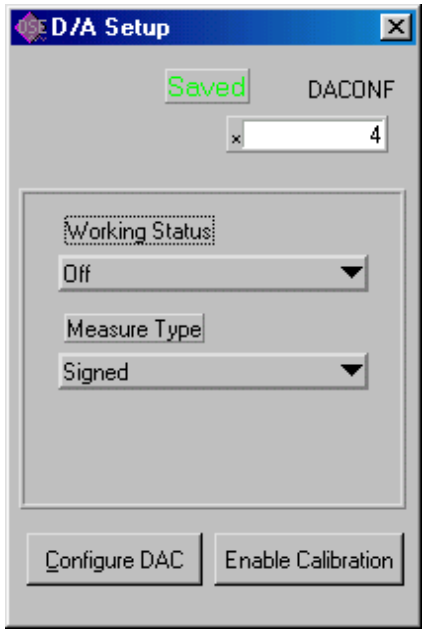
***Restore Default button*:** by pressing this button the system will copy the factory parameters into the User's parameters. This function has to be used if the parameters loaded on the User's profile do not lead to correct measurements. This operation performs a reset of the transducer.

The system, during calibration, show the message "#3 Invalid Command" if the user tries to use the wrong command. The message is a reply from the software if a command is improperly used and is rejected by the system (no changes have been performed).
If a setting is accepted the software will not show any message.

NOTE: Changes performed during User's calibration take full effect after a software reset or after a power off – power on sequence.

***Exit button*:** this button closes the Calibration window and performs a software reset disabling User's password.

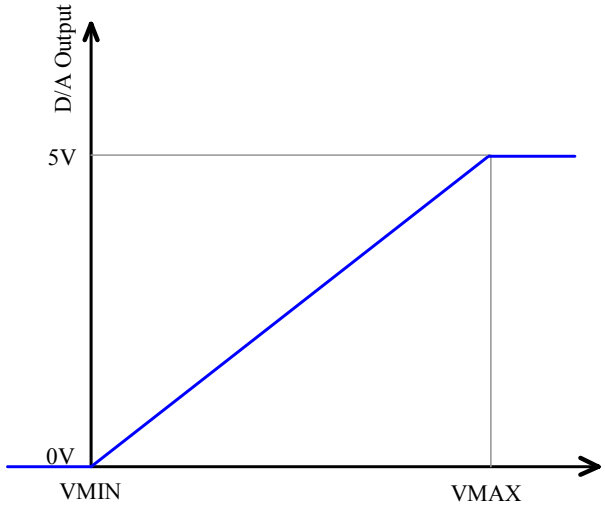
7.8 D/A SET UP FUNCTION



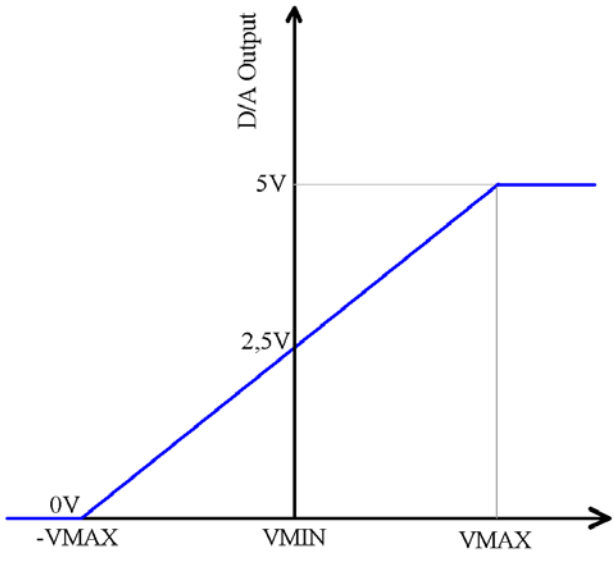
D/A Set up button opens a window that allows to set the behaviour of the D/A converter, if installed.
D/A output provides a 0 to 5 V output scaled with reference to VMIN and VMAX of the active Parameter Set (Factory or User); D/A output represents the analog value of VAL_NZDYN digital value, the value can be zeroed by means of Dynami Zero and Autozero functions.
Working Status: the D/A converter can be activated (On) or deactivated (Off).
Measure Type:

- Signed: zero reference is shifted to 2,5 V in order to have a ± 2,5 V of change, corresponding to ± VMAX. This can be useful to obtain a signal that will follow a traction/compression force applied on a load cell.
- Absolute: the output signal will be 0V at VMIN and 5V at VMAX; any negative value will be produce a 0V output.

Measure Type = Absolute



Measure Type = Signed



***Enable Calibration button*:** DA configuration is protected by a User's password in order to avoid accidental changes. The program will signal to the User that the parameter is protected if any change is performed without unlocking the protection. To unlock the protection press the Enable Calibration button once.
The password unlock is lost by powering down the transducer or by resetting it.

***Configure DAC button*:** sends the configuration to the system.

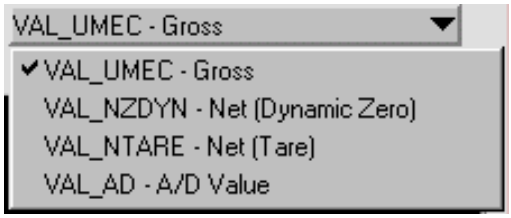
NOTE: analog output is updated with the same frequency selected for A/D AD_SPEED - A/D Output Frequency.

DACONF display shows the value of the parameter resulting from the settings performed (see Parameter's Table).
Click on the 'x' of the DACONF display to show the value expressed in decimal, hexadecimal, octal or binary format.
DACONF parameter collects several settings expressed in binary format (8 bits) with reference to the following table

Bit position	Description
0..1	Reserved
2	0 = Absolute output 1 = signed output
3	0 = disabled 1 = enabled
4..7	Reserved

7.9 TRACE RING

This ring allows to select the measurement type that will be displayed by the software, on the numeric display or with the graph, when START button is pressed.
By clicking it twice, the User displays full list of available measurement type, with the active one checked.
It is possible to change the measurement to be displayed with displaying active.
Available measurements are:



VAL_UMEC – Gross: system displays the gross measurement in engineering units. Decimal point, if needed, is to be set using View→Decimal Point command. This measurement is obtained by transmitting to the system a @?R01 command with DSEnet protocol.

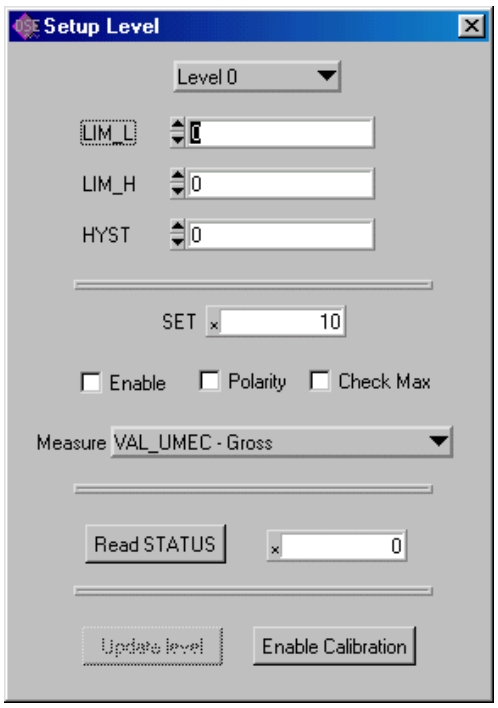
VAL_NZDYN – Net (Dynamic Zero): displays the Net measurement by subtracting the Dynamic zero value (defined by pressing the ZERO button) to the Gross measurement (Val_UMEC-ZDYN on Measurement's Table). This measurement is obtained by transmitting to the system a @?R02 command with DSEnet protocol.

VAL_NTARE (Tare): displays the Gross measurement without the TARE value. Note that TARE value can represent a fixed tare that has to be suppressed after transducer's installation, due to mechanical parts that are fixed on the transducer but are not to be measured. This measurement is obtained by transmitting to the system a @?R03 command with DSEnet protocol.

VAL_AD - A/D value: the direct reading from the A/D converter, without any additional computation on it. This measurement is obtained by transmitting to the system a @?R00 command with DSEnet protocol.

7.10 LEVEL FUNCTION

The system can compare the measurement with four levels (form level 0 to level 3).
Load cells and pressure transducers are not supplied with integrated relays or contacts, but the 698 digital conditioner has a corresponding number of relays whose status depends on the settings performed with this window.



Each level is defined by the following attributes:
Level ring: allows to select the level of interest from 0 to 3.
LIM_L data entry: used to enter LIM_L value as a signed integer.
LIM_H data entry: used to enter LIM_H value as a signed integer.
HYST: used to enter HYST value as an unsigned integer

SET: this parameter collects several setting expressed in binary format (8 bits) with reference to the following table.

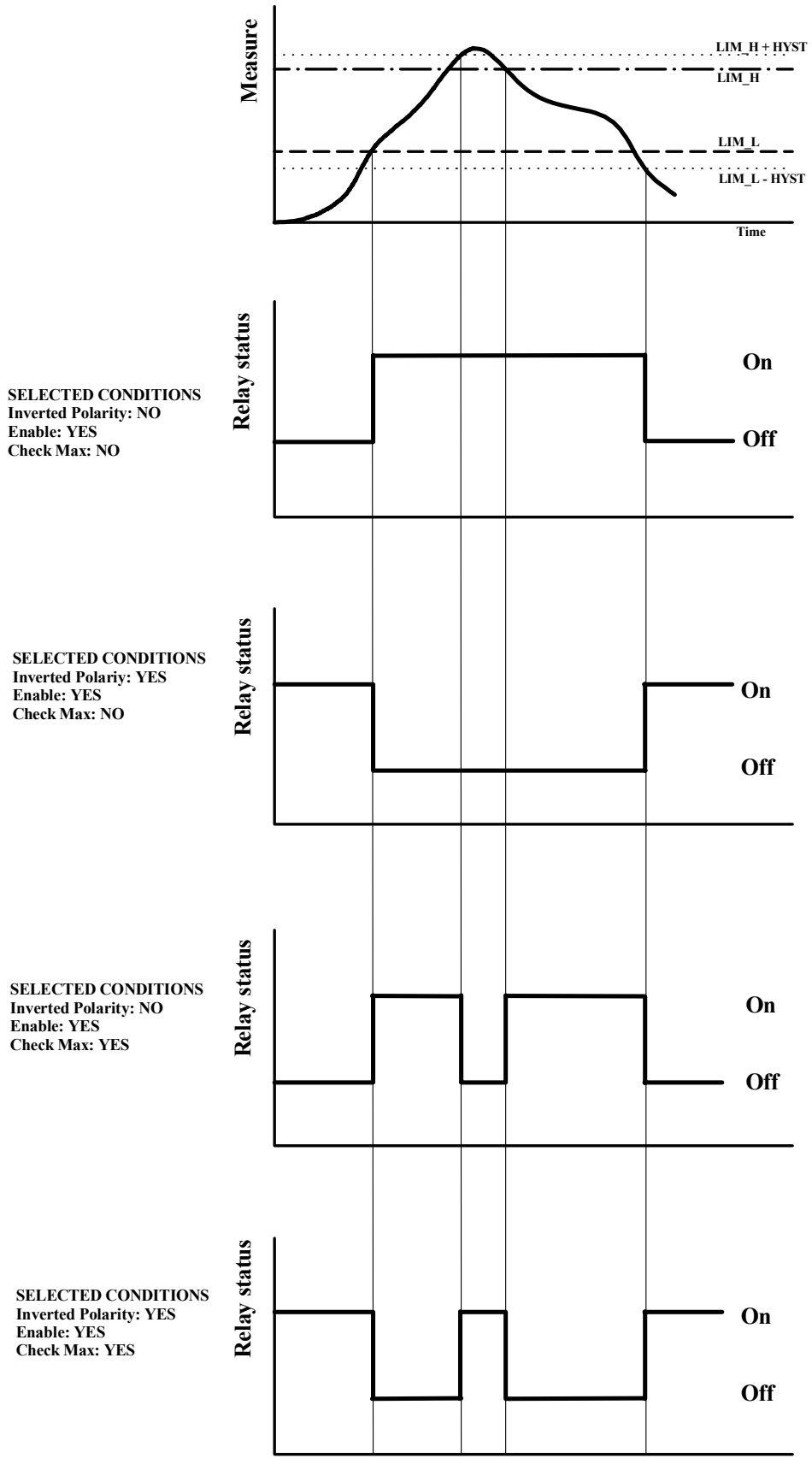
Bit position	Description
0	**Inverted polarity**: defines the output polarity: if checked (=1), polarity is Normally Closed (NC).
1	**Enable:** if checked (=1) level evaluation is enabled.
2	**Check Max:** if unselected (=0) only LIM_L is evaluated; if checked (=1) LIM_L and LIM_H are evaluated.
3	**Reserved**
4..7	**Measure**: Level evaluation is performed using the measure addressed with this index into Parameter's Table. A different Measure can be used to evaluate each level. LIM_L, LIM_H and HYST must be expressed in the same engineering unit and resolution as selected Measure.

SET display shows the value of the parameter that results from the settings performed (see Parameter's Table).
Click on the 'x' of the SET display to show the value expressed in decimal, hexadecimal, octal or binary format.

STATUS: this parameter collects status information for the level, in binary format (8 bits) with reference to the following table (see Parameter's Table).

Bit position	Description
0	If =0 measurement is < LIM_L or > LIM_H If =1 measurement is >= LIM_L and <= LIM_H
1	Reserved
2	Reserved
3	Reserved
4	If =0 relay disabled If =1 relay enabled
5	Reserved
6	Reserved
7	Reserved

As this settings are password protected first press the *Enable Calibration* button to unlock protection.
When all settings have been defined, press the *Update level* button so to download the settings to the system.

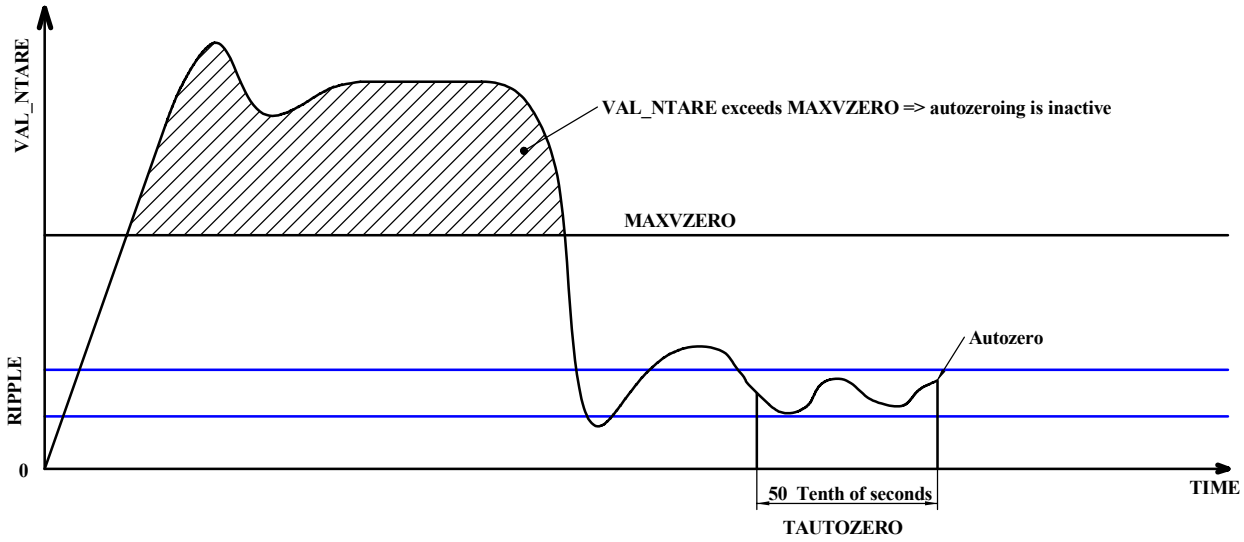

Measure
LIM_H + HYST
LIM_H
LIM_L
LIM_L - HYST
Time
Relay status
On
Off
SELECTED CONDITIONS
Inverted Polarity: NO
Enable: YES
Check Max: NO
Relay status
On
Off
SELECTED CONDITIONS
Inverted Polariy: YES
Enable: YES
Check Max: NO
Relay status
On
Off
SELECTED CONDITIONS
Inverted Polarity: NO
Enable: YES
Check Max: YES
Relay status
On
Off
SELECTED CONDITIONS
Inverted Polarity: YES
Enable: YES
Check Max: YES

7.11 AUTOZERO FUNCTION

This function performs autozeroing of the Net measurement (VAL_NZDYN) when enabled.
Parameters to be set on the Calibration panel are:

ENAZERO - Autozero enable	It enables the autozero function (0=disabled, 1= enabled). Autozeroing affects Net measurement (VAL_NZDYN) and is computed from absolute value of VAL_NTARE measurements.
TAUTOZERO - Autozero time window (1/10 s)	If load variation remains within RIPPLE value, for at least this time (in tenth of seconds), autozeroing is performed.
MAXVZERO - Autozero load window	Maximum value of VAL_NTARE (in modulus) allowed for autozeroing.
RIPPLE	Maximum measurement variation where autozeroing is allowed

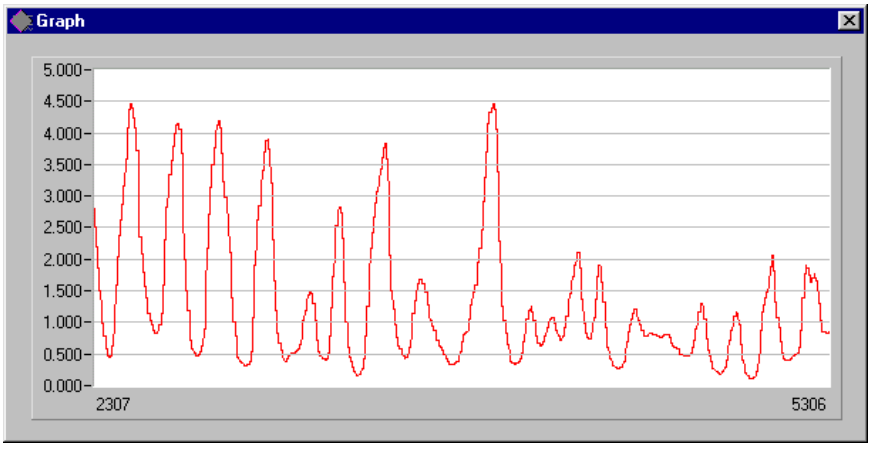
This function is intended to be used for unattended applications where zeroing has priority on measurement accuracy; we generally recommend to zero by external command.



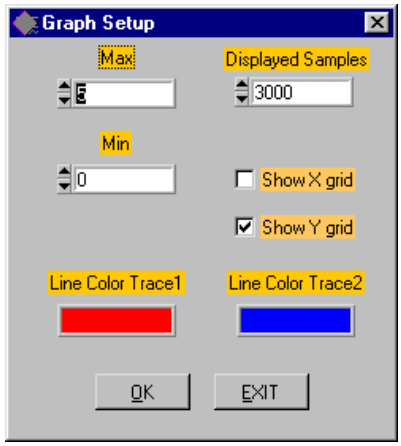
7.12 GRAPH VIEW BUTTON

This button shows a window used to graph the measurement data. This data is plotted like a strip chart, with the possibility to define the way data is displayed with the View→Graph Setup command.

Samples are equally spaced without any time relationship between them.



7.13 VIEW→GRAPH SETUP

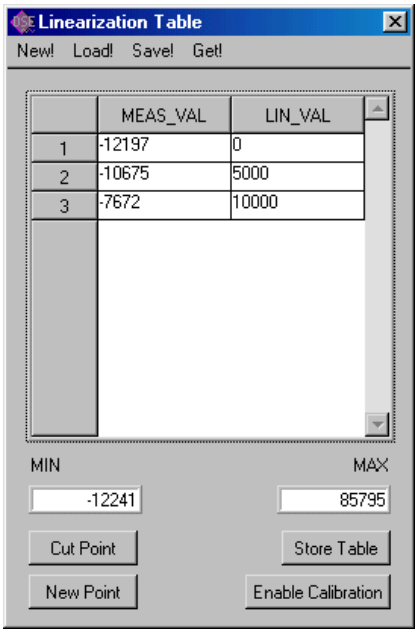


This command configures the Graph. The program can show up to two traces on the same graph. It is possible to define colour of the trace by clicking on the coloured area below "Line Color Trace".
Displayed Samples: allows to define the width of the X axis windows used to show the measurements.
Max: used to define Y axis maximum
Min: used to define Y axis minimum
Show X grid: select to show the X grid.
Show Y grid:. select to show the Y grid; by default it is always selected.
Exit button: closes the window and applies all changes. The graph is cleared.

7.14 VIEW→DECIMAL POINT

It defines the decimal point position to be used on the measurement display. This formatting applies also to the graph. The position refers to the rightmost character (Decimal point=0; no decimal point is applied). This value can range from 0 to 5.

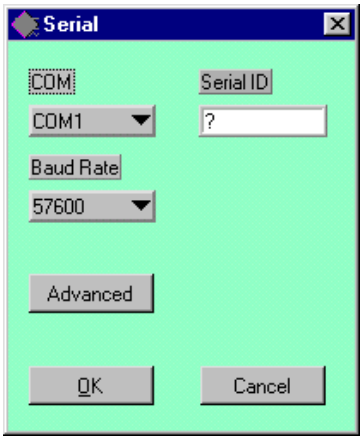
7.15 CONFIGURE→LINEARIZATION TABLE



This function allows to define an additional linearization table used by the system to convert measurements in engineering units. User may define a User's table with up to 8 additional linearization points. Each row of the table is a linearization point, defined by the A/D point (MEAS_VAL) and the corresponding value (LIN_VAL) in the same engineering units and resolution as VMIN and VMAX
For User's reference the MIN and MAX A/D values are listed. All the linearization points value (MEAS_VAL) must be between MIN and MAX.
To define a new point, load the transducer with the desired force, wait to get measurements as stable as possible and press *New Point* button to acquire the corresponding A/D value (MEAS_VAL).
To edit the LIN_VAL value, click twice on the value to be modified and enter the desired value in engineering units (integer number with the desired resolution).
When the table is complete (It is not necessary to define all the available 8 points) press *Enable Calibration* and *Store Table* buttons to store the table on the system's memory. Program will check for table's conformity; table is ordered for rising MEAS_VAL values, between MIN and MAX and rows with the same MEAS_VAL are not accepted. Linearization table will be used after a system's reset (or a power down and power on cycle). To delete a row from the table, press the *Cut Point* button and enter the index of the row to be deleted (from 1 to 8).
New!: allows to clear the current table so to define a new one from scratch.
Load!: used to load, from disk, a previously defined linearization table.
Save!: saves to disk a linearization table.
Get!: downloads and displays the table currently in use by the system.

Note: by transferring to the system an empty table (no rows) the system will convert the A/D measurements in engineering units using only the MIN,VMIN and MAX,VMAX points defined during system's calibration.

7.16 CONFIGURE→SERIAL



This command opens a windows can be used to set-up specific parameters for a serial connection.
Serial ID: as default the program looks for an instrument with ID=?. This character is used when the ID of the target system is unknown. Using the question mark, the remote system will always reply (there must be only one instrument connected to the computer trough a RS485 line).
COM: through this ring selector, the User can select the COM port to be used for serial communication. All the ports available on the computer will be listed (if correctly detected by Windows)
Baud Rate: all the possible baud rates, from 1200 to 115200 baud can be selected through this ring selector
Advanced Button: this button opens a new window by which additional settings can be performed.

Default connection parameters:

Data bit	8
Parity	None
Stop bit	1
Flow control	No

This parameters cannot be changed and are greyed.
RS-485:

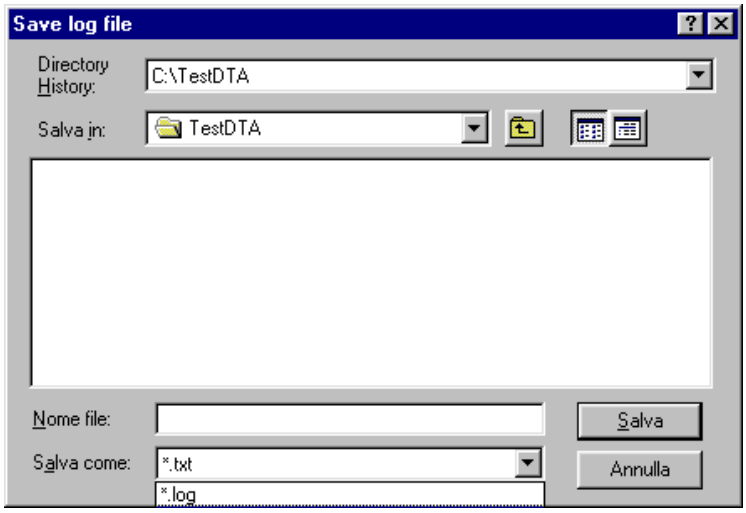
- *None*: no RS-485 interface is used internally to the computer. This is the default for RS 232 connections to RS232/RS485 external converters
- *Internal board*: if an internal RS-485 interface board is used on the computer, this setting can be used to solve communication problems due to the fact that the interface is not in automatic mode (it does not disable receive while transmitting data on the line). It can be applied to PCI/ISA/PCMCIA internal boards.

Please note that we have not tested all the interfaces available on the market.
DS Europe does not assure that the Digital Utility can work with any board on the market.

7.17 CONFIGURE→SERIAL SCAN

By choosing this command, a serial scan is performed searching for a transducer to connect with.
Please connect to a RS485 serial line only one transducer so to obtain a valid connection.
During "Serial Scan" the program scans all computer's available serial ports (COM ports) with the possible baud rates (from 1200 to 115200 baud).
You will see activity on the Tx led indicating that computer, at each combination of COM port/baud rate, is looking for a valid reply to the "@?V" command in order to conclude the search.
The program will stop with a "Error #2 No instrument connected" message, if no system is found.
When a valid connection is achieved, firmware release and serial number will be shown on the Title bar and the START button can be selected to activate a continuous display of the measurements.

7.18 CREATE LOG FILE



This function allows to create a log file of the measurements displayed by the Digital Utility.
This check box has to be selected before beginning the measurements of interest.
By pressing the *STOP button,* after the measurements, the program will ask for the name and the directory where to save the data file. Data file is always a plain text file that can have a ".log" or a ".txt" extension.
Data column are separated by TAB.
Timestamp column represents the time between measurements as measured by a free running 16 bit counter incremented by 1 at AD_SPEED frequency. At 65535 counter resets to 0.

Data file format

07-25-2001 19:43:02

Timestamp	Trace1
202	-5004
210	-5004
214	-5004
224	-5004
234	-5004
253	-1
255	-1
264	-1
274	-1
289	-2
294	-2
304	-2
314	-2
324	-2
334	-2
344	-2

8 LED FUNCTIONALITY

LED indicator may be installed inside the instrument to inform the User about the working status of the unit, without the need to connect it with a computer.
Some units, like the pressure transducers mod LP660, are not supplied of such LED indicators, due to space constraints.
Please refer to each product's description in order to find LED1 and LED2 position, if present.

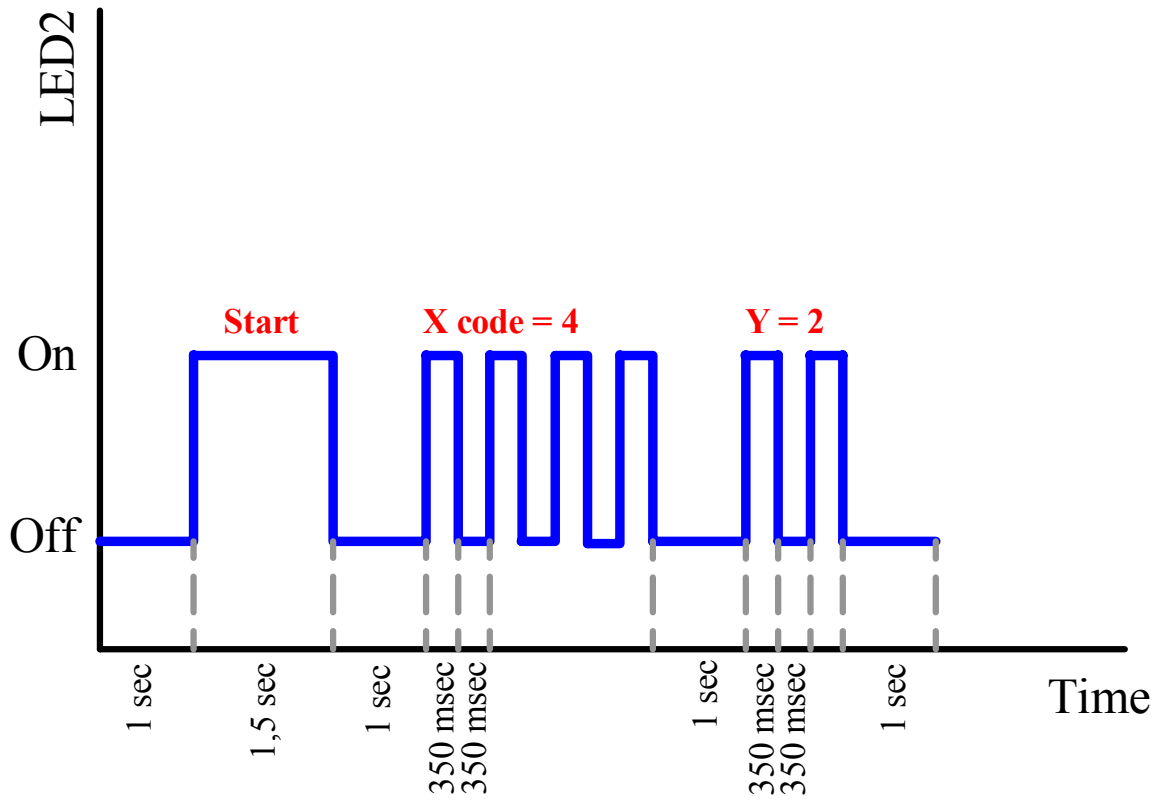
8.1 LED CODE

LED1: indicates the transducer serial line status. Normally it flashes with a 0,5 Hz frequency; additional flashing is modulated on it due to serial data traffic.

LED2: indicates error status by using a X-Y code, where X represents the error code and Y represents error detail.

Condition	X pulses	Y pulses
Normal working – No errors	1	1
A/D Converter not responding - timeout	2	1
Incorrect calibration – parameter values too near	3	1
Overload	4	1
Wrong linearization table	5	1
Invalid EEprom data	2	2

Flashing timing	LED status	Timing
Start	On	1,5 sec
	Off	1 sec
X code (i.e 4)	On (first)	350m sec
	Off	350 m sec
	……..	……..
	On (fourth)	350m sec
Pause between X and Y code	Off	1 sec
Y code (i.e 2)	On (first)	350m sec
	Off	350 m sec
	On (second)	350m sec
Final pause	Off	1 sec
Back to star sequence		



9 INPUTS FUNCTIONALITY

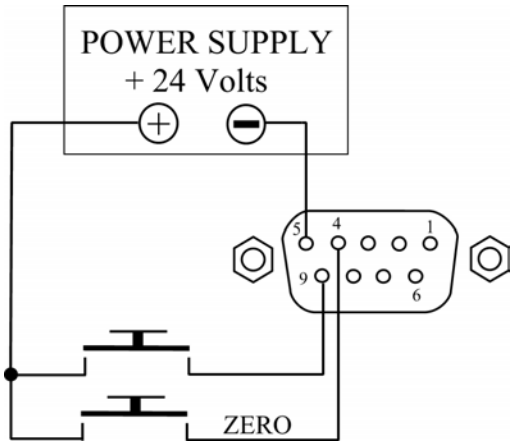
Two digital inputs are provided on the instrument; function associated to inputs is activated by means of application of an external +24V signal.

9.1 INPUT 1

INPUT1: performs Zeroing of the Net measurement (VAL_NZDYN).

9.2 INPUT 2

INPUT2: no function currently associated to this input



10 RESOLUTION VS. AD_SPEED

Typical performances table related to AD_SPEED setup, based on DS Europe system's design.

AD_SPEED	A/D converter output frequency	Internal A/D filter frequency (Hz) @ -3dB	Resolution (bit)
2	960	230	12
3	480	122	13
4	240	62	13
5	120	31	14
6	60	15.5	15
7	30	7.75	15
8	15	3.88	16
9	7.5	1.94	16

Above figures are based on typical performances declared by Cyrrus Logic, producer of the Crystal CS5532 A/D converter used in our product.

For more information please see Cyrrus Logic document DS289PP3-Oct.99 and further modifications.

NOTE: due to the low amplitude of the measured signal and to the high resolution of the system, measurements may be affected by electrical or mechanical noise.
A clean power supply, proper grounding and shielded cables are necessary to obtain proper measurements.

11 DSENET SERIAL PROTOCOL

Serial connection between a computer and a system is established with the following settings:
Default connection parameters:

Data bit	8	*Parity*	None
Stop bit	1	*Flow control*	No

DSEnet protocol is used to connect instruments manufactured by DS Europe with personal computer or other devices. Up to 36 systems may be connected to the same serial line (multidrop) with this protocol, when RS485 interface is used. An address (0 to 35) is uniquely assigned to each instrument.
The description will refere to Tables, Parameters, Value Tables and Calibration Tables that are specific for each instrument
Serial connection between Personal Computer and instrument is performed using ASCII strings with a fixed format.
Any command string must start with a @ character and must end with a CR (Carriage Return).

11.1 COMMAND STRING FORMAT

Position	Character	Meaning
0	@	Beginning of transmission
1	0-9, A-Z, ?	Instrument address code (max 36 instruments, please see note below) If a ? is used instead of an ID reference, instrument accepts any command independently from its ID (it is used to set the ID of a new instrument)
2	command	A letter identifying the desired function
3..n-1	0-9	Argument or extension of the command (if needed)
n	CR	End of transmission

NOTE:

- One ASCII character is used to address an instrument. Instruments 0 to 9 are addressed by using ASCII characters from "0" to "9", address coding continues with uppercase alphabet letters from "A" to "Z".
- When a new address has to be assigned to an instrument it is a numeric parameter (see Generic Parameter's table Ind=0220) where 10=A, 11=B up to 35=Z.

Command	Meaning
@HR01CR	Command R sent to instrument at address H = 17
@2R01CR	Command R sent to instrument at address 2 = 2
@CS022000000017 CR	Set parameter 220 on instrument at address C=12 to value 17=H

11.2 ALLOWED COMMANDS (CHARACTER IN THE SECOND POSITION)

Command	Meaning
G	Reads the value of a configuration parameter
R	Reads the value of a measurement
S	Sets the value of a configuration parameter
T	Calibration of a measurement parameter
V	Reads the firmware version number
Z	Resets the instrument or activates diagnostic functions

11.3 COMMAND DETAIL

11.3.1 G – Reads the value of a system parameter

The G command reads the value of a system parameter (see Parameter's table).
The command string has one argument: Gxxxx

xxxx	Parameter number, 4 digits, from 0000 to 9999 (see Parameter's table)

The system will return an answer in the following format:
xxxxGyyyyyyyy

xxxx	Parameter number, 4 digits, from 0000 to 9999 (see Parameter's table)
yyyyyyyy	Parameter value, 8 digits, from –9999999 to 99999999

Special Parameter Numbers can be used to request the complete parameter list from an unknown instrument:

- Parameter 9997: the system will initialize an internal counter and will return the value of the first parameter in the list.
- Parameter 9998: any request of this parameter will increment the internal counter and return the next parameter's value on the list. After the parameter list has been completely retrieved, the system will answer to a new request of parameter 9998 with a "%" to signal that the end of the list has been reached. No command is needed to exit from this procedure.

Shortly resuming, in order to retrieve the complete parameter list of an unknown instrument, the user must request parameter 9997 once and then request several times parameter 9998, until a "%" is received.

11.3.2 S – Sets the value of a system's parameter

S command sets the value of a system's parameter.
Command string has two arguments:
Sxxxxyyyyyyyy

xxxx	Parameter number, 4 digits, from 0000 to 9999 (see Parameter's table)
yyyyyyyy	Parameter value, 8 digits, from –9999999 to 99999999

11.3.3 R – Reads the value of a measurement

R command reads the value of a measurement (see Parameter's Table)
Note: when the command is sent as uppercase "R", the system returns reading without timestamp; when command is sent as lowercase "r" system returns reading with timestamp. Timestamp is a free running counter at 16 bit incremented by 1 at AD_SPEED frequency. At 65535 counter resets to 0.
Command string has one argument:
Rxx

xx	Number of the desired measure, 2 digits, from 00 to 99 (see Parameter's Table considering a two digits index)

System answer is a string with the following format:
Readings without Timestamp: xxRyyyyyyyy
Readings with Timestamp: xxRyyyyyyyyzzzzz

xx	Number of the desired measure, 2 digits, from 00 to 99 (see Measure Table)
yyyyyyyy	Measure value, 8 digits from –9999999 to 99999999 *Measure value can assume the following special values to signal system anomalies:* -999991 when A/D converter fault occurs; -999992 when calibration errors occurs (when values are too near or wrong); -999993 out of scale (transducer has been overloaded); -999994 wrong linearization table. **Note**: -999991 will be returned if any measure is requested, while all the other error values will be returned only for measurements converted in mechanical units.
zzzzz	Measure's Timestamp (Optional), 5 digits, from 0 to 65535

11.3.4 T – **Calibration of a parameter**

T command calibrates a parameter, by storing the current value acquired by the system's A/D converter into the chosen parameter. It applies, in example, to MIN, MAX,ZDYN values.
Command string has one argument:
Txxxx

xxxx	Parameter number, 4 digits, from 0000 to 9999 (see Calibration's Table)

NOTE: this command is valid only for parameters related to A/D measurement, listed on the User's Calibration parameter table.

11.3.5 V – **Prompts for the Identification string**

V command requests the system's identification string. The answer's table reports the reply string for each instrument.

11.3.6 Z – **Service functions**

Z command activates service functions.
Command string has one argument:
Zx
The argument x changes, depending from the instrument; if no argument is present, Z command will cause a system RESET (see Z command extensions).

11.4 ANSWERS FROM THE SYSTEM

The system replies to the command strings as described for each command, or with standard codes described hereafter.

Code	Meaning
!	Command executed successfully
?	Wrong command (not allowed)
$	Test programs entered, if available
&	Wrong command's argument
#	Read only parameter

11.5 PARAMETER'S PROTECTION

Two passwords are used to protect stored data. One password is reserved to DS Europe and protects factory parameter settings that are read only for the User.
A second password is reserved to User and protects the working parameters from unwanted modifications.
User's password use is straightforward: the value 1234 must be written into the User's Password parameter to modify any protected setting, otherwise any change will be rejected and system's parameters will remain read only.
Each time the system is powered off or a reset is triggered, the Password's parameter is zeroed, restoring the read only status of the parameters.

11.6 COMMAND SUMMARY

The available commands used to set main working parameters act on a database of parameters that may be read (***G** command*) or may be written (***S** command*).
Some special parameters have the additional possibility, to ease calibration, to store live values (A/D) using the ***T** command*. ***R** command* has to be considered as a simplified read command dedicated to instrument's measurements.

12 PROTOCOL PARAMETERS

This section describes the Tables used by the DSEnet protocol, with reference to digital load cell DC500.

12.1 SYSTEM IDENTIFICATION

Systems answers to the V command with the following string:

DC500 – V.xx.yy – S/N zzzzzz

xx	Firmware version
yy	Firmware revision
zzzzzz	System's serial number

12.2 COLUMN MEANING

- **Ind** parameter's index
- **Comm** are commands usable to set or read the different parameters
- **Prot** indicates protection level assigned to the parameter: **F** = Factory password protected, **U** = User password protected, **RO** = Read Only
- **Symbol** contains the symbol used as reference on the manual to indicate the parameter, indicating its function.
- **Min** indicates the minimum value allowed for the parameter.
- **Max** indicates the maximum value allowed for the parameter.
- **Default** indicates the default value for the parameter.

12.3 LINEARIZED MEASUREMENTS

System computes the linearized measurements in engineering units.

12.3.1 PARAMETER'S TABLE

MEASURE – This parameters contain instantaneous measurements

Ind	Comm	Prot	Parameter	Symbol	Min	Max	Default
0000	R/G	RO	A/D measurement	VAL_AD	-	-	-
0001	R/G	RO	Gross measurement, in engineering units	VAL_UMEC	-	-	-
0002	R/G	RO	NET measurement, in engineering units (Gross–ZDYN)	VAL_NZDYN	-	-	-
0003	R/G	RO	NET measurement, in engineering units (Gross–TARE)	VAL_NTARE	-	-	-

Warning: Measure value can assume the following special values to signal system anomalies:
-999991 when A/D converter fault occurs;
-999992 when calibration errors occurs (when values are too near or wrong);
-999993 out of scale (transducer has been overloaded);
-999994 wrong linearization table.
Note: -999991 will be returned if any measure is requested, while all the other error values will be returned only for measurements converted in mechanical units

LEVEL 0

Ind	Comm	Prot	Parameter	Symbol	Min	Max	Default
0100	G/S	U	Low limit	LIM_L	-999999	999999	0
0101	G/S	U	High limit	LIM_H	-999999	999999	0
0102	G/S	U	Hysteresis	HIST	0	100	0
0103	G/S	U	Settings	SET	0	255	0
0104	G	RO	Status	STATUS	0	255	0

LEVEL 1

Ind	Comm	Prot	Parameter	Symbol	Min	Max	Default
0105	G/S	U	Low limit	LIM_L	-999999	999999	0
0106	G/S	U	High limit	LIM_H	-999999	999999	0
0107	G/S	U	Hysteresis	HIST	0	100	0
0108	G/S	U	Settings	SET	0	255	0
0109	G	RO	Status	STATUS	0	255	0

LEVEL 2

Ind	Comm	Prot	Parameter	Symbol	Min	Max	Default
0110	G/S	U	Low limit	LIM_L	-999999	999999	0
0111	G/S	U	High limit	LIM_H	-999999	999999	0
0112	G/S	U	Hysteresis	HIST	0	100	0
0113	G/S	U	Settings	SET	0	255	0
0114	G	RO	Status	STATUS	0	255	0

LEVEL 3

Ind	Comm	Prot	Parameter	Symbol	Min	Max	Default
0115	G/S	U	Low limit	LIM_L	-999999	999999	0
0116	G/S	U	High limit	LIM_H	-999999	999999	0
0117	G/S	U	Hysteresis	HIST	0	100	0
0118	G/S	U	Settings	SET	0	255	0
0119	G	RO	Status	STATUS	0	255	0

Generic parameters

Ind	Comm	Prot	Parameter		Symbol	Min	Max	Default
0200	G/S	U	D/A Converter configuration		DACONF	0	255	152
0220	G/S	U	Serial address: even if protocol string uses 0-9 A-Z to address a system, address must be stored using decimal format. This means that A = 10, B = 11, up to Z= 35		ADDRESS	0	35	0
0221	G/S	U	Baud rate:		BAUD	0	6	6
			0 = 1200 1 = 2400 2 = 4800 3 = 9600	4 = 19200 5 = 38400 6 = 57600				
0250	S	U	Reset requests Set to 100 to reset system		C_RESET	0	999999	0
0300	G/S	U	Active calibration set: 0 = Factory calibration 1 = User's calibration		PAR_SET	0	1	1
0301	T/G/S	U	Dynamic ZERO		ZDYN	-999999	999999	0
0302	G/S	U	A/D converter output frequency:		AD_SPEED	2	9	2
			2 = 960 Hz 3 = 480 Hz 4 = 240 Hz 5 = 120 Hz	6 = 60 Hz 7 = 30 Hz 8 = 15 Hz 9 = 7,5 Hz				

System's parameters

Ind	Comm	Prot	Parameter	Symbol	Min	Max	Default
0900	S	-	User's password	UPASSWD	0	999999	0
0901	G	RO	Firmware version	VERSION	-	-	-
0902	G	RO	Manufacturer's code	PRODUCER	-	-	1
0903	G	RO	Product's code: 3=Digital load cell 5=698 Digital conditioner 6=LP668 pressure transducer	PRODUCT	-	-	
0904	G	F	Serial Number	SERNUM	-	-	-

User's calibration parameters

Ind	Comm	Prot	Parameter	Symbol	Min	Max	Default
0400	G/S	U	Minimum in engineering units Ch 0	VMIN	-999999	999999	0
0401	G/S	U	Maximum in engineering units Ch 0	VMAX	-999999	999999	1000
0402	T/G/S	U	Minimum's A/D value for Ch 0	MIN	-999999	999999	1000
0403	T/G/S	U	Maximum's A/D value for Ch 0	MAX	-999999	999999	5000
0404	T/G/S	U	Tare A/D value for Ch 0	TARE	-999999	999999	0
0410	G/S	U	Number of linearization points	TABLEN	0	8	0

User's linearization table

Ind	Comm	Prot	Parameter	Symbol	Min	Max	Default
3000	G/S	U	Linearized values in engineering units	LIN_VAL	-999999	999999	0
....		..	..		..	..	..
3007	G/S	U			-999999	999999	0
4000	G/S	U	A/D values	MEAS_VAL	-999999	999999	0
....		..	..		..	..	..
4007	G/S	U			-999999	999999	0

MEAS_VAL values must satisfy the following conditions:

If MIN <MAX then MIN < MEAS_VAL (4000)< MEAS_VAL (4001)< MEAS_VAL (.....)< MEAS_VAL (4007)< MAX

If MIN >MAX then MIN > MEAS_VAL (4000)> MEAS_VAL (4001)> MEAS_VAL (.....)> MEAS_VAL (4007)> MAX

12.3.2 Z command extensions

Value	Function
0	System's Reset is activated
3	User's calibration is substituted by Factory calibration

12.3.3 C_RESET values

Value	Function
100	System's Reset is activated

13 658 CONNECTION CABLE

Mod.698D DB9 MALE RS 485	Mod.658-5-X DB9 FEMALE
1 and 7	5
2 and 6	4

Mod.698D DB9 MALE RS 422	Mod.658-2 DB9 FEMALE
1	5
6	4
7	8
2	9

Mod.500QD/QDT CABLE RS 422	Mod.658-2 DB9 FEMALE
BLUE	5
BROWN	4
GREEN	8
VIOLET	9

Mod.500QD/QDT CABLE RS 485	Mod.658-5-X DB9 FEMALE
BROWN and GREEN	5
VIOLET and BLUE	4

Mod.LP668 CONNECTOR RS 422	Mod.658-2 DB9 FEMALE
4	5
3	4
5	9
6	8

Mod.LP668 CONNECTOR RS 485	Mod.658-5-X DB9 FEMALE
4 and 6	5
3 and 5	4

14 TERMS OF SALE

(These terms of sale are applicable to all DS Europe Products)

14.1 LIMITED WARRANTY

Several electrical and mechanical tests carried out during manufacturing process and the final test carried out on each unit warrant that delivered Product is free from defects in materials, workmanship and performance.
During the warranty period of six months from delivery, at no additional charge, Product rendered defective under normal use will be repaired or replaced at DS Europe factory.

The Product shall be forwarded at Buyer's expense concerning shipping, insurance, customs duties or any other charges associated with transportation of the Product.
This Limited Warranty does not extend to any Product that has been damaged or rendered defective as a result of accident, misuse, or abuse.
Moreover, in case of heavy or non-reparable damages, the Product may be rendered disassembled to the Buyer if the cost to re-assemble the Product will not be paid.
The Product contains firmware that is provided on an "AS IS" basis: essentially, firmware is in accordance with the description of the Product manual.
Except as expressly set forth in this warranty, DS Europe makes no other warranties, expressed or implied, including any implied warranties of merchantability and fitness for a particular purpose, concerning hardware and firmware of the Product and its relevant documentation.

This Limited Warranty does not extend to any semiconductors: integrated circuits, transistors, diodes, microprocessors, memories and whatever else not covered by semiconductor Manufacturers' warranty.

The Buyer shall check the delivered Product within 10 days from receipt; after this limit, the Product shall be considered accepted.

DS Europe liability is limited to the above; DS Europe is not liable for any personal injuries, damages to property or damages due to stoppage of machinery or plants caused by installation and use of supplied Product (including, without any limits, any lost profits, lost savings, stoppage of activities, lost information or any other economic losses).

14.2 LIABILITY FOR DAMAGES

DS Europe products are parts of more complex systems and plants; these are sold in thousands per year, for thousands different applications with thousands of norms and precautions concerning installation and use that are not known to the Manufacturer.

In case of installation or use that can directly or indirectly cause personal injuries, damages to property or damages due to stoppage of machinery or plants, before installation the Buyer shall immediately advise DS Europe that will stop purchase negotiation or suspend deliveries of the Product.

However, to minimize or to avoid risk of damages, DS Europe is available, without any responsibility, to suggest solutions and protection accessories, test certifications, competent Bodies or consultant Institutes.

Moreover, it is recommended to read carefully installation and use instructions attached to Product delivery.
These instructions can also be sent during purchase negotiation on Buyer's request.

NOTICE:
Even if not expressly mentioned, these "Terms of Sale" are integral and complementary part of any bulletin, invoice or instruction manual.

DS EUROPE S.R.L.

Terms of Sale no. 140998 of September 14th, 1998.