

VISULAR

USER'S GUIDE

SMPR CONTROLE

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FOREWORD

**READ THE SAFETY RULES OF
THE APPENDIX B VERY CAREFULLY BEFORE USING THE DEVICE**

WARNING

The information contained in this booklet can be changed without notice.

The manufacturer makes no warranty whatsoever with respect to the warranties of commercial quality of this product or its suitability to a particular use.

The manufacturer is not responsible for mistakes that could be found in this handbook and also for direct or indirect damage resulting from the equipment, its performances and the use of this product.

CLEANING

Use a soft cotton cloth slightly soaked with an ethyl alcohol based product.

DO NOT USE the following products : acetone, benzene, toluene and halogens hydrocarbons.

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1.1 PRESENTATION OF THE PRODUCT

The electronic comparator **VISULAR** enables to check dimensions from inductive and digital probes. It is possible to make simple measurements (with one probe), measurements of sums or differences (with 2 to 4 probes).

The measured values are compared with a reference piece : the master.

A comparator operated by a microprocessor

The electronic comparator **VISULAR** operated by a microprocessor is entirely programmable thanks to its keyboard. This way it can be used in many different configurations.

1.2 TECHNICAL SPECIFICATIONS

- 2 inputs for inductive probes, extensible to 4 (sensitivity 83 mV/V/mm on 2,74 kOhms).
- Bus RS485 for digital probes, maximum 4
- 4 control configurations (nominal value, tolerances, etc..) can be selected by keyboard or by external command
- Static and dynamic dimensions
- Display of the nominal dimension with 7 figures
- Over/under tolerance limits warning lights
- RS232 or RS485 communication port to connect with a PLC
- 16 key alphanumerical tactile keyboard
- Working temperature : +15°C à +30°C
- Relative humidity : maximum 80%
- Dimensions : 200 mm wide, 88 mm high, 140 mm deep
- Weight : 1100 grams

1.3 THE FRONT PANEL

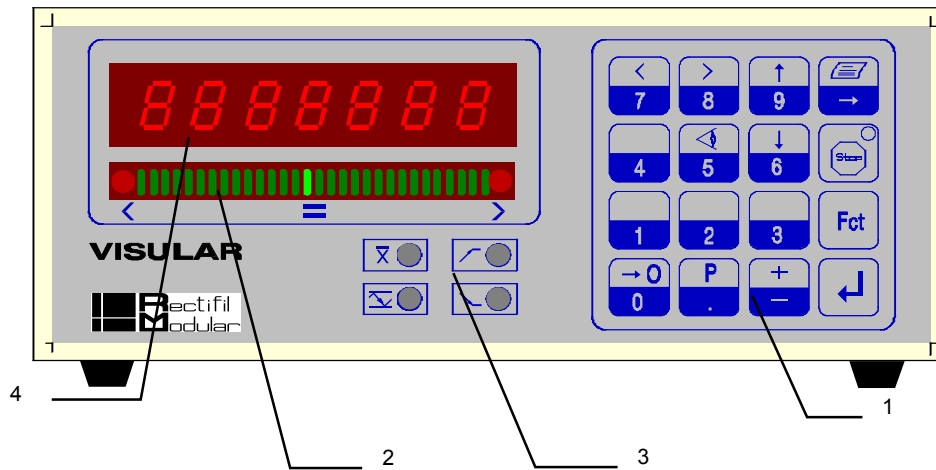


Fig. 1

The following functions are gathered on the front side :

1. the keyboard
2. 3 indicator lights, or an optional analog display- and 2 indicator lights
3. the indicator lights show the measuring mode
4. the digital display

1.4 THE BACK PANEL

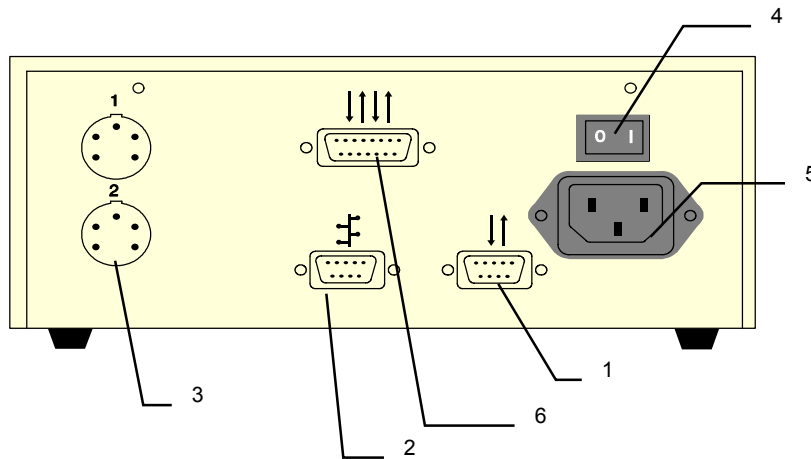


Fig. 2

The back side gathers several functions :

1. Port RS232 or RS485 used to connect with a PLC
2. RS485 is a bus used to connect digital probes
3. 2 DIN connectors 5 pins enable to connect two inductive probes
4. Power switch
5. The main connector
6. An optional connector for relay outputs and multi-functional inputs/outputs

1.4.1 THE COMMUNICATION PORT

The VISULAR is fitted with a serial port, marked \updownarrow . It enables to connect the device to an PLC or an external system. It is used in RS232 or in RS485 according to the acquired configuration. The transmission format is as follows :

1 start bit, 8 data bits, 1 stop bit, no parity
 The speed can be changed by the user.

CONNECTOR PIN ASSIGNMENT

It is equipped with a Sub D 9 pin- female plug.

Description of signals and pin assignment (version RS232).

Pin	Signal	Direction	Description
1			Not used
2	RX	Input	Reception of data
3	TX	Output	Transfer of data
4			
5	Ground	-	Ground / signal return
6 to 9			Not used

Description of signals and pin assignment (version RS485).

Pin	Signal	Direction	Description
1,4,6,7,8,9		-	Not used
2	A	$\leftarrow \rightarrow$	Emission/reception of data
3	B	$\leftarrow \rightarrow$	Emission/reception of data
5	Ground		

1.4.2 THE RS485 BUS

The VISULAR is fitted with a RS485 bus used to connect digital probes (marked 2 on Fig. 2).

“RS485 ” CONNECTOR PIN ASSIGNMENT

It is fitted with a Sub D 9 pin female connector.

Description of signals and pin assignment.





Pin	Signal	Direction	Description
1,4,5,9	0V	-	Power supply for probes
2	A	← →	Emission/reception of data
3	B	← →	Emission/reception of data
6,7,8	+5V		Power supply for probes

2. SIMPLIFIED STARTING

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The simplified starting includes the four points to follow to make the VISULAR work.

When it is switched on, the VISULAR is in measuring mode. The measuring mode carries out the reading of probes, calculates the dimension from programmed combinations, compares the dimension with tolerances and displays the results.

All the configurations are accessible and changeable according to the same principle : A combination of keys allows to have access to the function and to display the actual value. By pressing the  key you go back to the measuring mode without changing the configuration. To change the configuration you need to enter a new value instead of the displayed value or use the   keys if you choose pre-programmed values. By pressing the  key you go back to the measuring mode and store the new configuration.

2.1 PROBE COMBINATION

In measuring mode the VISULAR carries out the reading of probes, calculates the dimension from programmed combinations.




The calculation formula used is as follows :

$$(K1*C1) + (K2*C2) + (K3*C3) + (K4*C4)$$




The coefficients K1 to K4 are **real numbers** chosen in the interval $-20 < K < +20$.

A probe that is not used must be given the coefficient 0. The sign of the coefficient enables to choose the probe's direction.

The coefficients are displayed in the following way :

The combination of the keys   displays the coefficient K1. By pressing the  key you go back to the measuring mode.




The coefficients are entered in the following way :

The combination of the   keys displays the coefficient K1. The new coefficient chosen in the interval $-20 < K < +20$ is then entered by keyboard. The entry is ended by pressing the key . The same procedure enables to display and change the coefficients from K2 to K4. The original combination is $(1*C1) + (0*C2) + (0*C3) + (0*C4)$





2.2 TOLERANCE LIMITS






The tolerance limits determine how the indicator lights and relays work. The tolerance minimum corresponds to the minimum dimension of the part : ex 9.990 The maximum tolerance corresponds to the maximum dimension of the part : ex 10.010

Display of tolerance limits :

By pressing the   key, the minimum tolerance is displayed. By pressing the  key, you go back to the measuring mode.


Alteration of tolerance limits :


The key combination    displays the minimum tolerance. The new tolerance is then entered by keyboard. The entry is ended by pressing the key .



The same procedure enables to display and change the maximum tolerance by using the keys   and   .

2.3 DISPLAY AND ADJUSTMENT OF PROBES

This function is used to enable to adjust the mechanical position of probes on the measuring stand. The position of probes must be adjusted nearest to zero (at half the measuring stroke).



By pressing the key  the direct value of probe 1 is displayed without the calculation of the combination with other probes. In the case when the probe is of digital type, it must be identified. If it is not, the message IDEN is displayed. You must then press the end of the probe to enable its identification. As soon as you have done it, the probe's value is


displayed. By pressing the  key you go back to the measuring mode. The same procedure enables the display of probes 2,3,4.

The combination of the keys  then  cancels the identification of the digital probe 1. The message IDEN is then displayed. This procedure enables the change in probes.

2.4 DEFINITION OF THE MASTER'S DIMENSION AND CALIBRATION

The VISULAR measures by comparison with a reference piece, the master. For that, it is necessary to define the dimension of the reference piece. Then the VISULAR measures this master piece and stores the result as reference. This operation is called the calibration.

The combination of the   keys displays the actual value of the master piece. The new value of the master piece

can then be entered by keyboard. The entry ends by pressing the  key. This action triggers the reading of the master piece that must be present under the probe(s). The calibration is kept permanently until the next calibration procedure.

The VISULAR is now ready for operation.

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




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3.1 SELECTION OF CALIBRATION MODES

The VISULAR enables to choose between 2 calibration modes :

- **direct calibration.** The calibration is triggered by pressing the key combination  . Using the function in an inopportune way can have serious consequences, because it changes the reference of the measurement.
- **calibration and control of repetition.** In this mode, the calibration is carried out once in the same way as for the direct calibration. Then by pressing the  key on its own you control if the dimension read on the master piece hasn't changed by a greater value than the defined tolerance of repetition since the last calibration.





Selection of the calibration mode :


The combination of the    keys displays the calibration mode : « master piece » for direct calibration, or « control » for calibration and control of repetition. To change modes use the   keys.

By pressing the  key, you go back to the measuring mode.

3.2 CALIBRATION TOLERANCE

If the **Calibration and control of repetition** mode has been selected, a calibration tolerance must be defined. It is the maximum shift of the dimension read on the master piece that will be allowed in future different controls of repetition, by comparison with the dimension read on the master piece during the calibration.

The combination of the    keys displays the actual value of the calibration tolerance. The new value of the calibration tolerance is then entered by keyboard. The entry ends by pressing the  key which allows you go back to the measuring mode.

Then every time you press the  key, the VISULAR carries out a **control of repetition**. It means that the dimension read on the master piece that must be present under the probe(s), is compared with the dimension read during the calibration. If this dimension is different from the dimension of calibration by a bigger quantity than the specified one, an error message « E 5 » is then displayed. To go back to normal working, you either need to carry out another control of repetition with a difference lower than the calibration tolerance or make another calibration.

3.3 SELECTION OF THE MEASURING MODE

The VISULAR enables to choose between 5 measuring modes :

- *direct measurement*

The displayed value represents the measured value.

- *minimum value*

The displayed value represents the minimum value met since the beginning of the measuring. It is a dynamic measurement.

- *maximum value*

The displayed value represents the maximum value met since the beginning of the measuring. It is a dynamic measurement.






- *average*

The displayed value represents the average of the values met since the beginning of the measuring. It is a dynamic measurement.



- *difference*

The displayed value represents the difference between the maximum and the minimum met since the beginning of the measuring. It is a dynamic measurement.







Modification of the measuring mode:

The combination of the keys   displays the message MODE. The keys   enable to change modes. The selected mode is indicated thanks to 4 indicator lights. In direct mode, the 4 indicator lights are switched off. The modification ends by pressing the  key.

3.4 RELATIVE DISPLAY






By pressing the  key, the display and the maximum and minimum memories are reset to 0. The VISULAR then displays the moves from this origin. It is a temporary function that won't be saved. It can be used as many times as it is necessary. It stays on until you next press  again, or until the device is switched off.






3.5 NUMBER OF DISPLAYED DECIMALS


It is possible to choose the position of the decimal point. The change in position of the decimal point is obtained by combining the keys     or . If more than 3 decimals are requested in metric dimensions, the VISULAR uses the measuring range +/- 200µm and a resolution of 0.1 µm for inductive probes. The modification ends by pressing the key .

3.6 LIMITATION OF PROBE MEASURING RANGES

For greater working security, it is possible to limit the range in which the probes are allowed to work. This way, an error message is immediately displayed as soon as this probe goes out of the range.

The combination of the keys     displays the actual value of the maximum limit of probe 1. The new value of the maximum limit of probe 1 is then entered by keyboard. The entry ends by pressing the key .

The combination of the keys     displays the actual value of the minimum limit of probe 1. The new value of the minimum limit of probe 1 is then entered by keyboard. The capture ends by pressing the  key.








In the same way, we can display and change the limits of the other probes by changing the key  in the key combinations above with the number of the other probes.

3.7 SPEED SELECTION OF THE COMMUNICATION PORT

The VISULAR is fitted with a serial port, marked "↑↓". It enables to connect the device to a PLC or an external system. It can be used in RS232 or in RS485 according to the acquired configuration.

The transmission format is as follows :
1 start bit , 8 data bits, 1 stop bit, no parity.
The speed can be changed by the user.







The speed is regulated between 1200 and 19600 baud. The selection of the speed is obtained by combining the keys


    or  . The modification ends by pressing the  key.

The VISULAR is originally delivered with a speed regulated at 9600 baud.








3.8 REGULATION OF THE DISPLAY BRIGHTNESS

It is possible to regulate the display brightness according to eight levels.

The change of display brightness is obtained by combining the keys      or .








The modification ends by pressing the key .

3.9 MEASUREMENT UNIT : MILLIMETRE OR INCH

The combination of the keys      or  enables to choose between millimetre or inch as measurement units. The modification ends by pressing the key .




3.10 CONFIGURATION OF PROBE ENTRIES

The VISULAR allows you to use 4 probes. In its most current version, it is fitted with 2 inputs for inductive probes and a bus for digital probes. According to your needs, you can choose only one inductive probe, or even none. In this case, It is possible to modify the partition between inductive probes and digital probes. This partition is displayed by combining





the keys   . The display then shows C 2 2. The first 2 indicates the use of 2 inductive probes, the 2 to the right indicates the use of 2 digital probes. The keys   and  enable to modify this partition. The modification ends by pressing the key .


3.11 HOW THE INDICATOR LIGHTS WORK

If the part is out of tolerances, the corresponding indicator light comes on. It is possible to store a fugitive over/under tolerance limit by using the memorisation of over/under tolerance limits. The mode in operation is displayed by

combining the keys   . The display then shows M.Led 0 or M.Led 1.

0 indicates the over /under tolerance limits are not stored, 1 indicates the over /under tolerance limits are stored.

We change modes with and without storage of over/under tolerance limits with the keys   and . The modification ends by pressing the key .

The key  empties the memory of the indicator lights.

3.12 PROGRAMMING OF 0-10 VOLTS AND 4-20 mA OUTPUTS

When the multi-functional board ref OPT-MFCT (cf § 6.2) is installed, we have 2 analog outputs 0 to 10 Volts and 4 to 20 mA. The dimension corresponding to the output voltage 0 Volt and to the current 4 mA is entered by combining the

keys Example for 0 Volt = 10.5 mm, you press :

The dimension corresponding to the output voltage 10 Volts and to the current 20 mA is entered by pressing the keys

followed by the corresponding dimension.

3.13 PROGRAMMING OF THE SORT

The VISULAR enables to do A SORT. It is possible to define up to eight classes maximum, and to display directly the number of the class corresponding to the measured dimension.

When the multi-functional board ref. OPT-MFCT (cf § 6.2) is installed, each has a corresponding output on the connector.

To use the function SORT, you first need to **define the number of classes you want** with the key combination

then the keys

0 cancels the function SORT. 1 to 8 correspond to the number of classes.

Then the limits of each class need to be defined with the following key combinations :

to enter the lower limit of the first class, then end by pressing the key .

to enter the lower limit of the second class, then end by pressing the key.

It is the same for the following classes. You need to enter the upper limit of the last class, then end by pressing the key.

The key enables to go from the dimension display to the class display.

3.14 TEMPORARY CHANGE OF MEASURING MODE

This change enables to display all the information about the measured dimension (direct dimension, maxi, mini, average, difference). It is only for the numerical display. The tolerances always depend on the default mode.

The keys enable to go from one mode to the other. By pressing the key or by not touching the keyboard for 20 seconds, the display goes back to the default mode.

3.15 STARTING OF DYNAMIC MEASUREMENT





The 0 reset of the maximum and minimum memories used to measure shape faults is triggered by pressing the key

. The key must be pressed when the part is already adjusted under the probes not to record the erroneous data.

3.16 MEASUREMENT STOP

By pressing the key the measurements as well as the display stop. A red indicator light indicates the measurement stop. They will start again by pressing this key again. It is therefore possible to stop the display on a value, to stop a static or dynamic measurement temporarily or permanently.

3.17 MEASUREMENT WITH SEVERAL TYPES OF PARTS



The VISULAR has a memory that can contain 4 data sets corresponding to 4 different dimensions. It is possible to select active data by means of a command entered by keyboard. The key combinations   to   select the data sets from 1 to 4.

3.18 CALCULATION OF AVERAGES

The VISULAR allows to choose between two methods to measure an average dimension :

- an average calculated by adding all the readings made at regular intervals, divided by the number of measured values. This method necessitates a regular move of the part under the probe, as well as precise starts and stops of measurement.
- a median value calculated by doing the average of the maximum and minimum values met during the measuring.




Mode in operation :  





The display indicates MEDIAN 1 for the calculation of the median, MEDIAN 0 for the calculation of the average. To go from one to the other use the keys  and .

3.19 ADDRESS FOR MULTI-POINT COMMUNICATION

The device can communicate through the communication port, either through a specific protocol Metro (in ASCII), or through the ModBus/JBus protocol(binary).



The **number 0** selects the specific protocol Metro (configuration of origin). The ModBus/JBus protocol is selected by a device number **between 1 and 247**.

Access to the number by   .

You can then increase or decrease the number, by step of 1, with the keys  and . To change by step of 10, use  and .

3.20 LOCKING / UNLOCKING OF THE KEYBOARD

The use of advanced functions by keyboard can be protected. This locking can be put on or cancelled by the keyboard and by the communication port.

Locking :    Unlocking :   

4. COMMUNICATION PROTOCOLS

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4.1 STATUS REGISTERS

The VISULAR has 3 status registers internally (on 16 bits), in reading or in writing. These 3 registers describe and activate the different states and working modes of the system.

Register n° 1 'STATUS 1' :

bits 0,1,2	permanent measuring mode	RW	0 : normal 1 : average 2 : difference 3 : maxi 4 : mini
bit 3	calibration mode	RW	0 : calibration 1 : control
bits 4,5,6	part sets	RW	from 0 to 3
bit 7	Upper status indicator light & relays	R	0 : off 1 : on
bit 8	Lower status indicator light & relays	R	0 : off 1 : on
bit 9	measurement unit	RW	0 : mm 1 : inch
bits 10,11	(reserved, not to be used)		
bits 12 to 15	number of the activated class	R	from 0 to 8

Register n° 2 'ACTION' :

bits 0 to 4	reserved to 'actions'	W	0 : nothing 1 : set status 'Stop' 2 : reset status 'Stop' 3 : init. dynamic variables 4 : set relative display 5 : stop relative display 6 : checking calibration 7 : cancels access to functions 8 : enables access to functions 9 : calibration command
bits 5,6,7	number of decimals (1 to 5)	RW	
bits 8 to 11	displayed error number	R	from 0 to 15
bit 12	status of system	R	0 : active 1 : status Stop
bit 13	mode 'working indicator lights'	RW	0 : standard 1 : memorised
bit 14	calculation 'Average' or 'Median'	RW	0 : median 1 : average
bit 15	calibration check	R	1 : error E 05


Register n° 3 'STATUS 2'

bit 0	class display mode	RW	1 : class number
bit 1 to 4	number of classes	RW	see § 3.13
bit 5 to 7	number of inductive probes	RW	see § 3.10

Note : R = bit(s) in reading, W = bit(s) in writing

4.2 SPECIFIC PROTOCOL

In the following cases, with the device number equal to 0 :

- If the system receives the character ? (code \$3F),
- If the user presses the key ,
- if an impulsion is made on the entry 'PRINT' of the option 'multi-function' or 'relays',

The VISULAR will answer by the following message :

M	STATUS	ACTION	±000.00000	CR	LF
---	--------	--------	------------	----	----

M	'M'onocote - Visular
STATUS	status register 'STATUS' in hexa coded ASCII on 4 digits
ACTION	most significant byte of the status register 'ACTION' in hexa coded ASCII on 2 digits
value	displayed value on 10 digits with sign and 5 decimals
CR/LF	end of message (characters CR and LF)

The communication happens in ASCII, at the set up speed, on 8 bits without parity with one 1 stop bit.

4.3 MODBUS (or JBUS) PROTOCOL

4.3.1. GENERALITIES

The VISULAR works in slave mode.
 The protocol is used in its binary version.
 The communication is made by reading or writing registers (16 bits).

The general format of messages is as follows :

device number	code function	data	CRC 16 (lsb)	CRC 16 (msb)
---------------	---------------	------	--------------	--------------

- number device number (from 1 to 247) 1 octet
- code function code of the asked function 1 octet
- data N octets
- CRC 2 octets

specific use of the ModBus (or Jbus) protocol :

- Readings and writings are only made on 1 register (16 bits) or 2 registers (coded real numbers IEEE-754 format)
- only the following functions are used :
 - reading of a register or 2 registers (1 real) : code 03
 - writing of a register or 2 registers (1 real) : code 16 (\$10)
- the most significant byte of the registers and real numbers are transmitted first, except the CRC

Note : in IEEE-754 format, a real is coded, on 32 bits, in the following way :
 1 sign bit, exponent on 8 bits, mantissa on 23 bits :
 4 octets : MMMMMMMM MMMMMMMM EMMMMMMM SEEEEEEE
 [E = exponent (two's complement with offset 127), S = sign (1 if <0)]

4.3.2. NUMBERS OF REGISTERS

Status Register	STATUS1	1
Status and action register	ACTION	2
Status Register	STATUS2	3

4.3.3. NUMBERS OF REAL VALUES

	<i>dec.</i>	<i>hex.</i>
Lower tolerance	10	0A
Upper tolerance	12	0C
Dimension of the master piece	14	0E
Tolerance of repetition of the master piece	16	10
Displayed value	18	12
Coefficient probe 1	20	14
Coefficient probe 2	22	16
Coefficient probe 3	24	18
Coefficient probe 4	26	1A
Lower limit probe 1	28	1C
Lower limit probe 2	30	1E
Lower limit probe 3	32	20
Lower limit probe 4	34	22
Upper limit probe 1	36	24
Upper limit probe 2	38	26
Upper limit probe 3	40	28
Upper limit probe 4	42	2A
Lower limit class 1	44	2C
Lower limit class 2	46	2E
Lower limit class 3	48	30
Lower limit class 4	50	32
Lower limit class 5	52	34
Lower limit class 6	54	36
Lower limit class 7	56	38
Lower limit class 8	58	3A
Upper limit class 8	60	3C
Value of 0V (or 4 mA)	62	3E
Value of 10V (or 20 mA)	64	40

4.3.4. READING REGISTERS

Break down of questions from the computer :

device number	code \$03	number of 1st register	nb registers 1 or 2	CRC 16 (lsb)	CRC 16 (msb)
1 octet	1 octet	2 octets	2 octets	1 octet	1 octet

Break down of answers to the computer :

device number	code \$03	read octets 2 or 4	1 or 2 read registers 2 or 4 octets	CRC 16 (lsb)	CRC 16 (msb)
1 octet	1 octet	1 octet	2 or 4 octets	1 octet	1 octet

4.3.5. WRITING REGISTERS

Break down of questions from the computer :

device number	code \$10	number of 1st register	nb registers : 1 or 2	octets : 2 or 4	values to write 2 or 4 octets	CRC 16 (lsb)	CRC 16 (msb)
1 octet	1 octet	2 octets	2 octets	1 octet	2 or 4 octets	1 octet	1 octet

Break down of answers to the computer :

device number	code \$10	number of 1 st register	number of registers 1 or 2	CRC 16 (lsb)	CRC 16 (msb)
1 octet	1 octet	2 octets	2 octets	1 octet	1 octet

4.3.6. ERROR MESSAGES

The general format of an error message is as follows :

device number	function code + \$80	error code	CRC 16 (lsb)	CRC 16 (msb)
------------------	-------------------------	------------	-----------------	-----------------

The most significant bit of the received function code is forced to 1 to indicate the error.
used error codes :

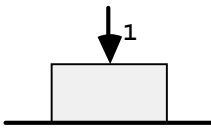
- \$01 unrecognised function code
- \$02 unknown register number
- \$17 wrong request parameters

5. EXAMPLES OF PROBE COMBINATIONS

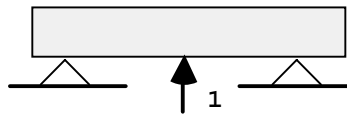
5.1 SIMPLE MEASUREMENTS WITH ONE PROBE..... 20
 5.2 COMBINED MEASUREMENTS WITH TWO PROBES 20
 5.3 MEASUREMENTS WITH THREE PROBES 21
 5.4 MEASUREMENTS WITH FOUR PROBES 21

5.1 SIMPLE MEASUREMENTS WITH ONE PROBE

In the following examples the probe combinations are expressed as follows :
 K Cn [K stands for the coefficient applied to probe C number n]

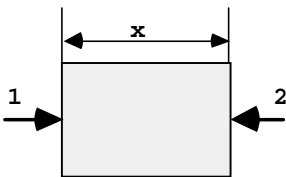


+1 C1
Thickness

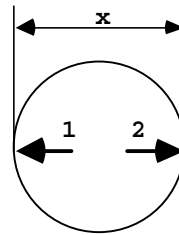


+1 C1
Flatness

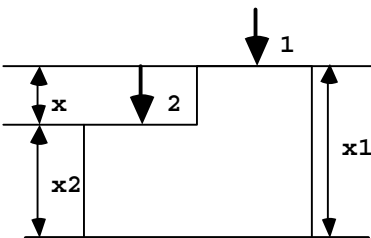
5.2 COMBINED MEASUREMENTS WITH TWO PROBES



+1 C1 +1 C2
Thickness or external diameter

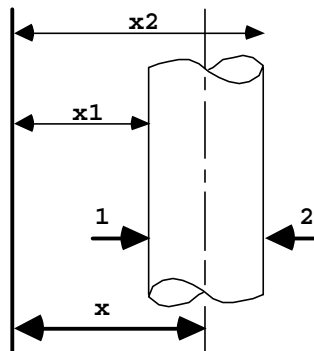


-1 C1 -1 C2
Width or internal diameter



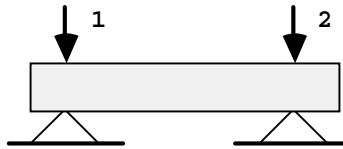
X1= +1 C1
X2= +1 C2
X = +1 C1 -1 C2

Unhooking



X1= -1 C1
X2= +1 C2
X = -0.5 C1 +0.5 C2

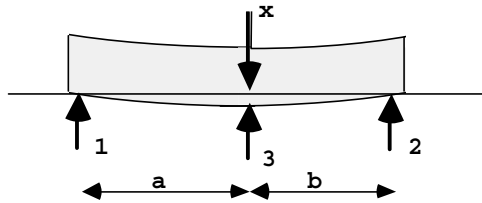
Position



Parallelism

$$X = +1 C1 - 1 C2$$

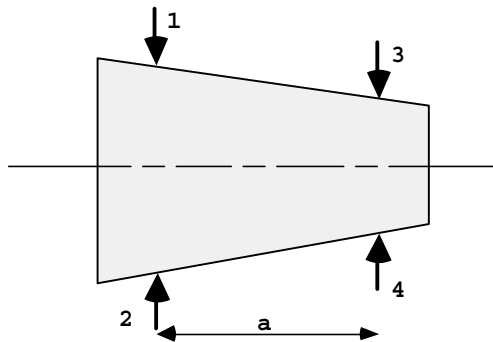
5.3 MEASUREMENTS WITH THREE PROBES



$$X = b/(a+b) C3 - b/(a+b) C1 - a/(a+b) C2$$

Straightness

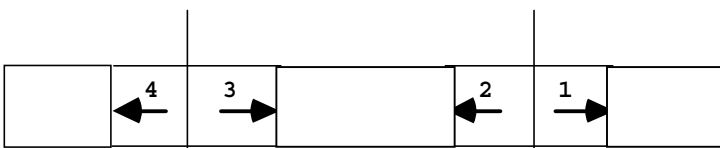
5.4 MEASUREMENTS WITH FOUR PROBES



Conicity

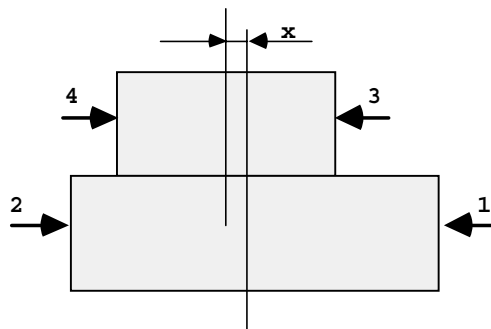
$$X = 1 C1 + 1 C2 - 1 C3 - 1 C4$$

$$dV = 1/a C1 + 1/a C2 - 1/a C3 - 1/a C4$$



Distance between axes

$$X = -0.5 C1 + 0.5 C2 + 0.5 C3 - 0.5 C4$$



Concentricity

$$X = (0.5 C1 - 0.5 C2 - 0.5 C3 + 0.5 C4)$$

6. INPUTS / OUTPUTS

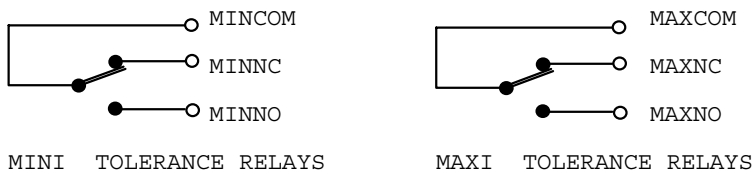
6.1 RELAY BOARD REF. OPT-REL 22
6.2 MULTI-FUNCTIONAL BOARD REF OPT-MFCT 23

The VISULAR can be fitted with the 2 following input / output boards :

- **Relay board ref. OPT-REL** the contacts of two relays show the position of the measured value by comparison with the tolerances. It also has 4 remote control inputs that make the measurement automatic.
- **Multi-functional board ref. OPT-MFCT**, it not only has the functions of the relay board, but also 8 programmable sorting outputs, and two analogue outputs (0-10 Volts and 4-20 mA) that also are programmable.

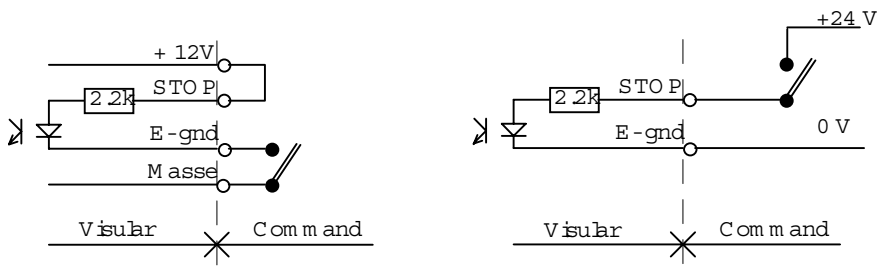
6.1 RELAY BOARD ref. OPT-REL

The relay board has two independent and isolated relays indicating the position of the displayed measurement by comparison with the tolerances. Each relay provides a contact that is normally open in case the measurement is within the tolerances (MINNO and MAXNO) and a contact that is normally closed (MINNC and MAXNC). The commons of each relay (MINCOM and MAXCOM) are independent, so that the user is as free as possible.



Four inputs isolated by optocouplers enable to operate the VISULAR by remote control. They are active at the logical level 1 (+12 to + 24 Volts) that must be maintained at 1 for 50 milliseconds minimum. The command is effective when the input comes back to zero, except for the input STOP that stays active as long as the logical level 1 (+12 to + 24 Volts) is maintained.

- **INITDYN** This input controls the initialisation of memories for the dynamic measurement. It must be used every time the dynamic measurement starts, when the part to be measured is already in place under the probes. This command has the same function as the keyboard key
- **STOP** This input controls when the measurement stops as long as it is maintained at the logical level 1. This command has the same function as the key
- **ZERO** This input controls the zero reset of the display. The display then indicates the variations of the measurement in comparison with this origin. This command has the same function as the key
- **PRINT** This input controls the sending onto the port COM1 of the displayed measured value. This command has the same function as the keyboard key combination



Example of a command with an internal source (not isolated) and with an external source (isolated).

The VISULAR has a memory that can contain 4 data sets corresponding to 4 different measurements. It is possible to select active data with a command applied on the inputs :

The reading of the ZERO and PRINT inputs is triggered by an impulsion on the INITDYN input maintained at 1 for 50 milliseconds minimum when the STOP input is active.

The combination of the ZERO and PRINT inputs determines the data to be activated according the following table :

PRINT Input	ZERO Input	Selected data
0	0	1
0	1	2
1	0	3
1	1	4

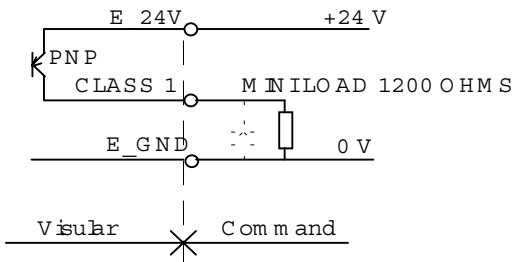
SUB D connector pin assignment

Pins	Signal	Direction	Description
1	+12 V	output	Power supply to activate the inputs
2	nc	-	Not connected
3	MINNC	-	Mini tolerance relays contact 1A 48V
4	MINCOM	-	Common of mini tolerance contacts
5	MINNO	-	Mini tolerance relays contact 1A 48V
6	E_GND		Power return of the inputs
7	STOP	input	Command for measurement stop
8	PRINT	input	Command for measurement transfer
9	Ground	-	Earth / power return 12V
10	nc	-	Not connected
11	MAXNC	-	Maxi tolerance relays contact 1A 48V
12	MAXCOM	-	Common of maxi tolerance contacts
13	MAXNO	-	Maxi tolerance relays contact 1A 48V
14	INIDYN	input	Command for measurement initialisation
15	ZERO	input	Command for display reset to zero

6.2 MULTI-FUNCTIONAL BOARD REF OPT-MFCT

The multi-functional board ref. OPT-MFCT has not only the functions of the relay board but also 8 programmable sorting outputs and two analogue outputs (0-10 Volts and 4-20 mA) that also are programmable. For the description of common functions, please read the above description of relay board.

The eight sorting outputs are of PNP type with an open collector according to the following drawing. They have a commutation power of 20 mA under 48 Volts.



Example of use of a sorting output

connector pin assignment :

Pins	Signal	Direction	Description
1	MINNO	-	Mini tolerance relays contact 1A 48V
2	4-20 OUT	-	Analog output 4-20 mA
3	+12 V	Output	Power supply to activate the inputs
4	Class 4	Output	Class 4 output
5	Class 2	Output	Class 2 output
6	Class 5	Output	Class 5 output
7	Class 7	Output	Class 7 output
8	E_GND		Power return of the inputs
9	E_24V	Input	24 V external power supply for sorting
10	MINCOM	-	Common of mini tolerance contacts
11	4 -20 RET	-	Analog output return 4-20 mA (-12V)
12	0 -10 V		Analog output 0 -10 V
13	Ground	-	Earth / power return 12V
14	Class 3	Output	Class 3 output
15	Class 1	Output	Class 1 output
16	Class 6	Output	Class 6 output
17	Class 8	Output	Class 8 output
18	E_24V	Input	External power supply 24 V for sorting
19	MINNC	-	Mini tolerance relays contact 1A 48V
20	MAXNO	-	Maxi tolerance relays contact 1A 48V
21	MAXCOM	-	Common of maxi tolerance contacts
22	MAXNC	-	Maxi tolerance relays contact 1A 48V
23	INIDYN	Input	Command of measurement initialisation
24	STOP	Input	Command for measurement stop
25	ZERO	Input	Command for display reset to zero
26	PRINT	Input	Command for measurement transfer


The analogue output type "current loop 4/20 mA" is used to transmit an analogue signal on a long distance. The loop current takes the following values :

- display = mini threshold gives a 4 mA current
- display = maxi threshold gives a 20 mA current

The maximum admitted resistance in circuit output is 500 Ω, connection cables included. The return of the analogue output 4-20 mA is connected to the potential -12V in comparison with the mass of the device.

7. ERROR MESSAGES

Every time the VISULAR detects an error, it displays an error message as long as the error stays. The only way to go back to a normal situation is to cancel the error. The error messages are displayed as follows : Ex, were x represents the error number.

Message	Cause	Action
E1	Exceeded range on probe 1	- coming back to the measuring range of the probe - change the measuring range of the probe if it is incorrect.
E2	Exceeded range on probe 2	idem
E3	Exceeded range on probe 3	idem
E3	Exceeded range on probe 4	idem
E5	Exceeded tolerance of repetition during the control on the master piece	- measure the master piece again - make another calibration - change the tolerance of repetition.
E6	Time exceeding in dynamic measurement (in the average measuring mode)	press the key  to reset to zero the maximum and minimum memories used to measure the shape faults.
E11 à E14	Probe 1 to probe 4 don't answer	- check the probe connection - Identify the digital probes

8. APPENDIXES

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APPENDIX A

ONE YEAR LIMITED WARRANTY ON VISULAR PARTS

MANUFACTURER'S RESPONSIBILITY

VISULAR - PRODUCTS HARDWARE AND LABOUR PARTS. From a period of one year from the effective warranty date, the manufacturer will pay for service labour and replacement parts. Replacement parts may be new or manufactured at the option of the manufacturer and are warranted for the remaining portion of the original warranty period.

FIRST END- USER COVERAGE. This warranty applies only to the first end-user of the product and is not assignable to any other subsequent purchaser or user.

NOT COVERED. Any accessory or expansion item not included in the original factory packaging for the product is not covered.

Costs of installation or adjustment or damage resulting from causes beyond the control of the manufacturer, including acts of God, misuse, neglect, accident damage occurring in shipment or from improper installation, operation or application ; or damage resulting from use of products, components, accessories or expansion items not supplied by the manufacturer are not covered. It also does not cover products which have been altered in any way without the written approval of the manufacturer including electrical or mechanical alteration, removal of serial numbers or the manufacturer trademarks or other identification.

THE SOLE REMEDY UNDER THIS WARRANTY SHALL BE REPAIR OR REPLACEMENT OF DEFECTIVE PARTS AS PROVIDED ABOVE. UNDER NO CIRCUMSTANCES SHALL THE MANUFACTURER BE LIABLE IN ANY WAY TO THE USER FOR INDIRECT, SPECIAL, INCIDENTAL OR CONSEQUENTIAL DAMAGES, INCLUDING BUT NOT LIMITED TO, ANY LOSS OF DATA, BUSINESS OR PROFITS, WHETHER OR NOT FORESEEABLE AND WHETHER OR NOT BASED ON BREACH OF WARRANTY. ACCORDING TO THE PRESENT GUARANTEE, THE ONLY RECOURSE WILL BE

THE PRESENT WRITTEN WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING BUT NOT LIMITED TO ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, AND ALL WARRANTIES ARE EXPRESSLY EXCLUDED AND NEGATED.

OWNER'S RESPONSIBILITY

OPERATING MANUAL AND OTHER DOCUMENTATION. Please read your operating manual and other documentation very carefully so that you have a good understanding of how it works. It may be possible to avoid unnecessary service work which may not be covered by this warranty.

AFTER SALES SERVICE. If the product is defective, take it to an authorised dealer.

APPENDIX B

SAFETY NOTICES

CAUTION : To reduce the risk of electric shock which could cause personal injury, follow all safety notices. The symbols shown are used in your documentation and on your equipment to indicate safety hazards.

CE : This device corresponds to the EN 61010-1 safety standard and EN55022 class B, CEI 801-2 (level II), CEI 801-3 (level III), CEI 801-4 (level IV) electromagnetic compatibility.

The user is cautioned that changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

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