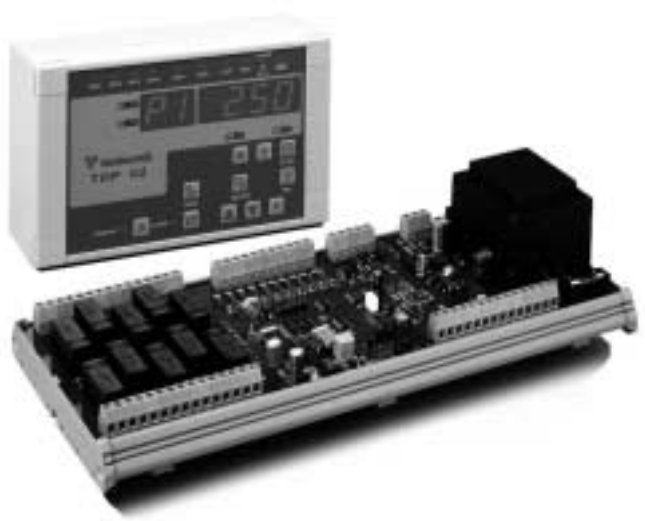
TDC 02 - TDP 02

MICROPROCESSOR-BASED ELECTRONIC MULTICOMPRESSORS REFRIGERATING UNIT CONTROL SYSTEM



OPERATING INSTRUCTIONS
Vr. 01 (ENG) - cod.: ISTR 04891

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PREVIOUS STATEMENT

In this manual are contained all the necessary information for a correct installation and the instructions for the use and the maintenance of the product; we recommend, therefore, to read carefully the following instructions. The maximum care has been used in the realisation of this document, anyway TECNOLOGIC S.p.A. does not assume any responsibility deriving from the use of itself. The same consideration has to be done for each person or Company involved in the creation of this manual. The herewith issue is an exclusive property of TECNOLOGIC S.p.A. which forbids any reproduction and divulgation, although partial, if not expressly authorised. TECNOLOGIC S.p.A. reserves the right to execute aesthetically and functional modifications, at any moment and without any notice.

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1 - DESCRIPTION

1.1 - GENERAL DESCRIPTION

TDC 02 model is a digital microprocessor based controller used to manage multicompressor refrigerating units with control of pressure/temperature whether suction or condensing temperature with ON/OFF, Neutral Zone or Proportional control.

TDC 02 unit is programmable through an operator interface TDP02 which can be located up to 600 mt. far away from TDC unit to which communicates by means of a 2 poles shielded cable, through a serial port CAN type.

TDC control unit is equipped with up to :

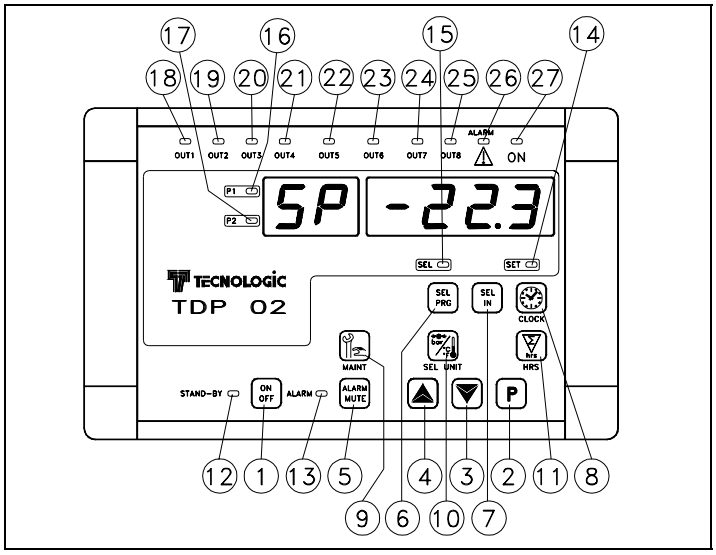
- 10 relay outputs : 8 of them to control the actuators (compressors, multistage valves or ventilators (OUT...OUT8), 1 alarm (ALARM) and controller output on (ON).

- 10 digital inputs: 8 of them to signalise the alarms and deactivate the actuators control output (ALARM OUT1 ... OUT8) 1 to select the program (P1/P2) and 1 as generic alarm (ALARM GEN.)

- 2 inputs for normalised signals (0/4...20 mA, 0/1...5V, 0/2...10V) for PTC or NTC temperature probes: 1 to measure the pressure/temperature of suction or condensing whether it's desired just to control the ventilation (INA1), 1 to measure the pressure/temperature of condensing (INA2) and furthermore it can be equipped with:
- RS485 serial interface, optoisolated
- internal clock to automatically switch over two control programs with different functioning parameters (ex. night/day, working days/holidays etc.) and to storage the alarms.

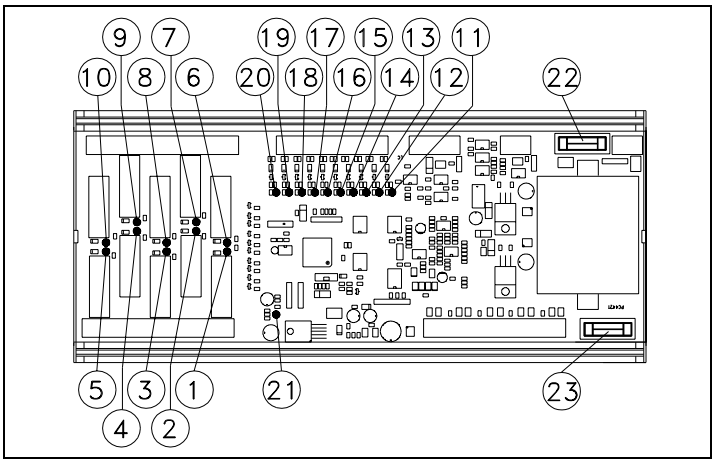
TDC unit can be programmed by a PC and execute the plant control also without the connection to the TDP interface.
TDP operator interface is equipped with : one 6 figures display, 11 keys, 16 signalling led and one internal buzzer for the alarms signalling.

1.2 - TDP 02 PANEL



1 - Key ON/OFF : It's used to switch on (RUN mode) or switch off (STANDBY mode) the controller
2 - Key P : It's used to program the Set Point and the functioning parameters
3 -Key DOWN : It's used to decrease the values to be programmed and to select the parameters
4 - Key UP : It's used to increase the values to be programmed and to select the parameters
5 - Key ALARM MUTE : It's used to silence the current alarm and to visualise the alarms stored in memory
6 - Key SEL PRG : It's used to select the program (P1-P2)
7 - Key SEL IN : It's used, when there is more than one probe, to visualise the temperature measured by the desired probe
8 - Key CLOCK : It's used to program the up to dated hour and day
9 - Key MAINT : It's used to switch into "maintenance" (deactivate) the control outputs
10 - Key SEL UNIT : It's used to commute the visualisation of the measured values of pressure and temperature and vice versa
11 -Key HRS : It's used to visualise the running hours of the motors driven by the control outputs
12 - Led STANDBY : It indicates the controller state in STANDBY mode
13 - Led ALARM : It indicates the alarm state on (switch on), off (switch off), silenced (flashing slowly) or stored (flashing rapidly).
14 - Led SET : It indicates the access to the Set Point programming (switch on), to the programming of visible parameters (flashing slowly) or to the programming of parameters protected by the password (flashing rapidly).
15 - Led SEL : It indicates the access to the SEL mode and then the possibility to select the program (P1 o P2)
16 - Led P1 : It normally indicates that the program P1 is working, while in the parameters programming mode, it indicates whether the parameter is referred to program P1
17 - Led P2 : It normally indicates that the program P2 is working, while in the parameters programming mode, it indicates whether the parameter is referred to program P2
18 ... 25 - Led OUT 1 ... 8 : They normally indicate the state of the control outputs : on (switched on), off (switched off), nearly activated or deactivated (flashing slowly) or deactivated because of an alarm or maintenance (flashing rapidly). In the visualisation mode of motors running time and maintenance (flashing slowly) they indicate to which output the visualisation is referred.
26 - Led ALARM: It indicates the state of the alarm output
27 - Led ON : It indicates the state of the controller in RUN mode and of the output ON switched on

1.3 - TDC 02 CONTROL UNIT



1 ... 8 - Led OUT 1 ... 8: Its indicates the OUT 1 ...8 control output state
9 - Led ALARM (OUT): It indicates the Alarm output state
10 - Led ON : It indicates the ON output state
11 ... 18 - Led ALARM OUT 1 ... 8 : Its indicates the alarm inputs state which deactivates the control outputs.
19 - Led ALARM GEN. (IN) : It indicates the Generic Alarm input state
20 - Led P1/P2 : It indicates the P1/P2 input state
21 - Led Supply : It indicates the Power supply of the unit
22 - Fuse 1 : Power supply fuse (F 315 mA 5x20 for supply. 110/230 VAC; F 1 A 5x20 for supply 24 VAC)
22 - Fuse 2 : TDP supply fuse (F 500 mA 5x20)

2 - PROGRAMMING

2.1 - SET POINT PROGRAMMING
Push key P then release it, led SET will be switched on and the display will show **"SP"** and the set point of the regulator 1 will be programmed on the active program (P1 or P2) with the unit of measurement defined on par. "nU".
To modify it, work on keys UP to increase the value or DOWN to decrease it.
These keys count one digit at a time, but if they are pressed for more than one second the value increases or decreases in a faster way.
The outgoing from the Set programming mode occurs automatically not pushing any key for about 5 seconds, thus the display will come back to the normal visualisation.
Whenever the control regards whether compressor or fans, to program the fans control set (regulator 2) it will be necessary, during the set programming mode of regulator 1, to push again key P and then release it.
The display will visualise **"SF"** and the set point of regulator 2 will be programmed on the active program (P1 or P2) with the unit of measurement defined on par. "nU".
To modify it, work as already explained for the programming of the first set point.
Pushing again key P the program goes back to the programming of SP and so on, up to the outgoing from the programming mode, which always occurs automatically after 5 sec. of the keys unactivity.

2.2 - HOUR AND DAY PROGRAMMING

When the instrument is equipped with the internal real time clock it's necessary to program it with hour and day as follows :
Push key CLOCK and keep it pushed for 5 sec., afterwards the display will show **"CL"** and the actual hour with the decimal point to separate hours and minutes.
Pushing keys UP and DOWN, during the hour visualisation is then possible to modify it to program the current hour.
Pushing again the key CLOCK within 10 sec., the display wil show **"dy"** and the current day of the week (1=Sunday, 2=Saturday...).
Pushing keys UP and DOWN, during the day visualisation is then possible to modify it to program the current day.
To go out from the clock programming mode, do not work on any key for about 10 sec.; the instrument will automatically return to the normal visualisation mode.
If the instrument is not equipped with the clock and it's tried to get into the hour programming mode, the display will show **"noCL"**.

2 2.3 - PARAMETERS PROGRAMMING

To accede to the instrument operating parameters it is necessary to press key P , keep it pressed for about 5 seconds, afterwards the led SET will flash and the code of the first parameter will be visualised on the 2 figures display, while on the 4 figures display it will be visualised the value of that parameter.
Now, key P can be released and, pressing key UP or DOWN , the desired parameter can be selected.
The parameter reference to program P1 or P2, it's signalled by the lighting of led P1 or P2.
Whether the parameter is referred to both programs, both led will be lighted off.
Once the parameter on which we intended to operate has been selected to modify it press P, than released it, the set of the parameter will show up.
To modify this value press UP or DOWN so as to increase or decrease the value.
Once the desired value has been programmed, press and than release key P and the display showing the selected parameter label will stop flashing.
Pressing keys UP or DOWN it is therefore possible to choose another parameter and modify it as previously described.
To outgoing from the programming mode do not work on any key for about 20 seconds, the instrument will automatically return to the normal functioning mode.

2.4 - RESTORATION OF THE ORIGINAL CONFIGURATION

Whenever it's desired to restore the instrument to the values of visibility and programming of the original parameters (programmed at the factory) it's possible to do it following the next procedure :
Program 481 on parameter "PP", pushing then key P it will appear parameter **"rS"** , programmed = oF.
Programming this parameter = on and pushing key P, it will be restored the original configuration and the instrument will come back to the parameters programming phase.

3 - INSTALLATION AND USE ADVICES

3.1 – USE ALLOWED

The instrument has been projected as measure and control device, built according to EN61010-1 rule.
The use of the instrument for applications not expressly allowed by the above mentioned rule has to foreseen proper protection devices.
The instrument CAN'T be used in environments with dangerous atmosphere (flammable or explosive) without a proper protection.
It has to be reminded that the user has to take care that the electromagnetic rules are being respected also after the instrument installing, eventually using proper filters.
Whenever a failure or a bad functioning of the instrument may cause dangerous situations or damage to people, things or animals it has to be reminded that the plant has to be equipped with additional electromechanical devices in order to grant the safety.

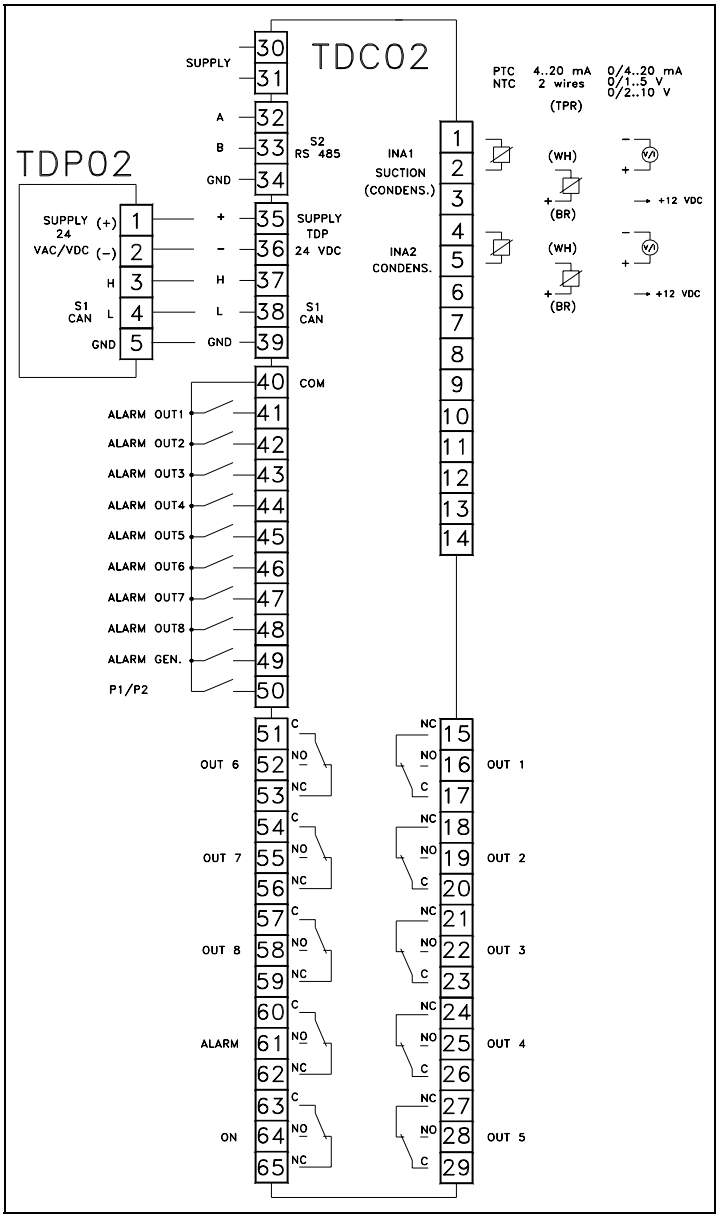
3.2 - MECHANICAL MOUNTING

TDC instrument is studied to be mounted backboard on OMEGA DIN RAIL, while TDP interface is foreseen to be wall mounted or in flush panel.
It's advisable to mount the apposite gasket and to use proper connections to connect TDP panel in order to obtain the IP65 protection degree.
Avoid to place the TCD unit into environments with high humidity or dirt, which may create condensation or contact with conductive substances.
It's advisable to assure an adequate ventilation to the instruments and to avoid the installation into box where are placed devices which may overheat the instrument and make it work at higher temperatures than what declared.
Do install both devices as far as possible from generators of electromagnetic noises so as motors, power relays, relays, electrovalves, etc.

3.3 - ELECTRICAL CONNECTIONS

Carry out the electrical wiring according to the following diagram, connecting only one wire for each terminal, checking that the power supply is the same as indicated on the instrument label and that the load current is not upper than the maximum current admitted.
TDC unit, although is a built in equipment with permanent connections into a cabinet, is equipped with internal devices protecting from overcurrent (fuses) as regard his supply and supply output to TDP panel.
It's recommended then, to properly protect all the electric circuits connected to the instruments through the outputs, with devices (ex. fuses) proportionate to the circulating currents.
The instrument, being a built in equipment with permanent connection into a cabinet, is not equipped with internal devices protecting from overcurrent: the installation shall, therefore, employ a two-phase switch, placed as near as possible to the instrument, located in a position easily reachable by the user and marked as instrument disconnecting device.
Furthermore, it's recommended to properly protect all the electric circuits connected to the instrument, with devices (ex. fuses) proportionate to the circulating currents.
It's strongly recommended to use cables with proper insulation, according to the working voltages and temperatures.
Furthermore, the input cable of the probe has to be kept separate from line voltage wiring in order to avoid electromagnetic noises infiltration.
If the input cable of the probe is screened, it advisable to connect it on the ground with one side only.
If the connecting cable between TDP and TDC units is short and the supply to TDP panel is given by TDC unit (through terminals 35-36) to communicate are enough only 2 wires not shielded (H-L).
Otherwise, if the units are far away one from the other, it's advisable the connection with a 2 pole shielded cable (or 4 poles if it's desired to comprehend the supply as well) with the braid connected to GND terminal from one side only. If, instead, the supply to TDP panel is not given by TDC unit, it's necessary the connection between the units with 3 wires (H-L-GND) and if they are far away it's better to use a 3 poles shielded cable with the braid connected to GND terminal from one side only, or a 2 poles shielded cable (H-L) with the braid connected to GND terminal from both sides.
For the eventual separate supply of TDP panel it's recommended to use the apposite transformer TCTR of minimum 3VA, or others with similar features, and to use the transformer to supply exclusively the panel.
Finally, it is advisable to check that the parameters are those desired before connecting the outputs to the actuators in order to avoid plant anomalies which may cause injuries to people, things or animals.
Tecnologic S.p.A. and its legal representatives are not responsible for any eventual damages to people, things or animals deriving from the instrument violation, not proper or wrong use or in any case not in accordance with the instrument features.

3.4 - ELECTRICAL CONNECTION DRAWING



4 - OPERATING MODE

Here following are indicated and described the functions of the complete system control (TDC02-TDP02), whenever the operator interface (TDP) is not present, the control board (TDC) actuates, in any case, all the control functions herewith described.

4.1 - ON/OFF (RUN/STANDBY)

Once supplied, the system can assume 2 different conditions :
- ON (RUN) : this means that the controller activates all the control functions. TDP interface presents then all displays and led activated, except led Standby (switched off).
- OFF (STANDBY) : this means that the controller does not activate any control function.

TDP interface presents then display and led switched off, except led Standby (switched on).
In case of power failure then, when the power comes back, the system will be in the same condition it had before the interruption.
When the controller is in the ON state it's activated also the ON output, which is deactivated only when the controller is in the OFF state, in case of power failure or in case of a general anomaly of the instrument.

4.2 - OUTPUT DELAY AT POWER ON

With parameter :
"od" - Delay at power on (in min.)
it's possible to delay the control outputs activation (OUT1...OUT8) at power on (more precisely at the passage into the run state).
The delay state is indicated by the display which shows, during the delay, alternatively **"od"** and the process value INA1.

4.3 - MEASUREMENT AND VISUALISATION

The instrument can be equipped with inputs for temperature probes (PTC or NTC) or for pressure probes (with normalised output signal).
Anyway, because it's existing a direct relation between temperature and pressure, depending on the type of the refrigerating gas used, it's possible to visualise (and obviously to use as set values) indifferently pressure or temperature independently by the range measured by the probe.
Into the instrument are then inserted the relations between pressure (in bar) and temperature of the refrigerating gas mostly used; to be able to visualise correctly and indifferently temperature or pressure it's necessary to select the type of refrigerating gas used in the controlled plant, through parameter :
"rt" : Refrigerating gas used
0 = None (the instrument doesn't effect any conversion);
1 = R134A ; **2 = R22** ; **3 = R502** ; **4 = R404A** ;
5 = R 717 (AMMONIA) ; **6 = R507** ; **7 = R407A** ;
8 = R407B ; **9 = R407C** ; **10 = R410A** ; **11 = R32** ;
12 = R125
The option 0 has been considered because, if the measure is not done with bar unit, but maybe with psi unit or some other unit of measurement, in this case the conversion function is deactivated in order not to give a wrong visualisation.
As some gas have different features depending on the passage from gas state into liquid one and vice versa it has been necessary to consider two different conversion curves depending on the side of the probe location (suction or condensing).
So, through par. "1A", additionally to the specification of the action type , it will be necessary to specify if the probe INA1 is located on the suction or on the condensing side.
As regard the input INA2, this problem doesn't exist because it's obvious that the probe will be placed always on the condensing side, as the regulator 2 controls the fans. (see also paragraph "Control actions").
The instrument can normally visualise (and it's possible to program the set values) the temperature also if it's measured the pressure and vice versa, depending on what programmed on par.:
"nU" : Unit of measurement for normal visualisation and programming
- PP = pressure (bar) for both inputs
- tt = temperature (°) for both inputs
- tP = temperature for input 1 and pressure for input 2
- Pt = pressure for input 1 and temperature for input 2

Concerning the temperature, it can be normally visualised in °C or °F, depending on par. :
"ru" : Temperature unit of measurement
- C = Centigrade
- F = Fahrenheit

Furthermore, through par.:
"dP" - Display resolution
- H = temperature resolution 0,1° and pressure 0,01
- L = temperature resolution 1° and pressure 0,1

Additionally to the modification of the visualisation, par. "dP" modify automatically also the Set resolution (SP" and "SF").
If the input/s are for normalised analogue signals, are obviously presents the parameters :
"1S" : Beginning scale of input INA1 for normalised signals, which defines if the input has beginning at value 0 as 0 mA or 0V (0) or at a different value from 0 as 4 mA, 1V or 2V (n0).
"1L": Lower limit of input INA1 for normalised signals.
"1H": Higher limit of input INA1 for normalised signals.
"2S" :Beginning scale of input INA2 for normalised signals (equal to "1S")
"2L": Lower limit of input INA2 for normalised signals.
"2H": Higher limit of input INA2 for normalised signals.
through which it's possible to program the values for a correct measurement.

It has to be underlined that, to control the refrigerating units, are normally used pressure probes with 2 wires with output 4...20 mA and range -0,5 ... 7 bar in order to measure the suction pressure (Tecnologic TPR01) and range 0 ... 30 bar in order to measure condensing pressure (Tecnologic TPR02).
Obviously the measure of the normal visualisation can be corrected through the parameters :
"C1"- Measure calibration of probe INA1
"C2" -Measure calibration of probe INA2
Normally, the operator panel display shows :
"P1" (if nU=PP or Pt) or **"t1"** (if nU=tt or tP) and the value measured by the probe connected with INA1.
It's possible to visualise the value measured by the probe INA2 (if present and activated by par. "2P") pushing and releasing the selection key of the visualisation probe (SEL IN), the display will show then :
"P2" (if nU=PP or tP) or **"t2"** (if nU=tt or Pt) and the value measured by the probe connected with INA2.
After 5 seconds of the key inactivity, the display comes back to the normal functioning showing the process value of the probe INA1.
In every moment it is possible to commute the visualisation of the measure visualised on that moment (from pressure to temperature and vice versa) pushing and releasing key SEL UNIT; after 5 seconds the display comes back to visualise the unit normally programmed.
This conversion function anyway, is not activated if par. "rt" = 0.

4.5 - PROGRAM SELECTION (P1-P2)
The control board can execute the outputs control following 2 different programs in memory.
Actually the program executed is always the same , but with different functioning parameters (Set Point, control type, control band, etc.).
This function permits to store on the board the parameters relative to different room control conditions (ex.: working days / holidays, day / night functioning, winter / summer functioning, etc.)
Two led P1 and P2 indicate the program in execution.
The selection of the program to be executed can be actuate in three ways :
1) Through the digital input of the program selection (P1/P2), which, if opened, activate program P1, if closed, activate program P2.
To the digital input can be then connected a clock contact or a simple switching by means of which it's possible to manage the execution of the desired program.
2) When the digital input is opened, the selection can be activated also through TDP interface, with the following procedure :
pushing and releasing key SEL PRG, led SEL will switch on; to select the desired program work then on keys UP or DOWN.
Not pushing any key, after 5 sec., led SEL will switch off, the display will come back to the normal visualisation mode and will be then executed the selected program.
If the program in execution is P2, as the selection digital input is closed, and it's tried to change the program into P1 through the panel, the display will show **"Err"**, because the digital input command has priority on the panel one.
3) When the digital input is opened, the selection can be also activated automatically at programmed hours and days (maximum is admitted 1 cycle of daily commutation), programmed by using the following parameters :
"e1" : Ending hour of program P2 automatic execution Sunday
"b1" : Beginning hour of program P2 automatic execution Sunday
"e2" : Ending hour of program P2 automatic execution Monday
"b2" : Beginning hour of program P2 automatic execution Monday
"e3" : Ending hour of program P2 automatic execution Tuesday
"b3" : Beginning hour of program P2 automatic execution Tuesday
"e4" : Ending hour of program P2 automatic execution Wednesday
"b4" : Beginning hour of program P2 automatic execution Wednesday
"e5" : Ending hour of program P2 automatic execution Thursday
"b5" : Beginning hour of program P2 automatic execution Thursday
"e6" : Ending hour of program P2 automatic execution Friday
"b6" : Beginning hour of program P2 automatic execution Friday
"e7" : Ending hour of program P2 automatic execution Saturday
"b7" : Beginning hour of program P2 automatic execution Saturday
The range of this parameters is: (oF- 0.00 ... 23.59).

For example :

Parameters		Day	P2 in execution
e1 = oF	b1 = oF	Sunday	P2 all the time
e2 = 10.00	b2 = 21.30	Monday	end of P2 at 10.00 and beginning of P2 at 21.30
e3 = 6.00	b3 = 21.30	Tuesday	end of P2 at 6.00 and beginning of P2 at 21.30
e4 = 6.00	b4 = 21.30	Wednesday	end of P2 at 6.00 and beginning of P2 at 21.30
e5 = 6.00	b5 = 21.30	Thursday	end of P2 at 6.00 and beginning of P2 at 21.30
e6 = 6.00	b6 = 21.30	Friday	end of P2 at 6.00 and beginning of P2 at 21.30
e7 = 6.00	b7 = 22.00	Saturday	end of P2 at 6.00 and beginning of P2 at 22.00

So, program P2 will start every day at 21.30 and will finish at 6.00 of the next day, except Sunday when the program will start at 22.00 on Saturday and will finish at 10.00 on Monday.

Remarks : obviously, when it's programmed a beginning execution hour for P2 program and at that hour the program P2 is already running, because it has been started up the day before, program P2 remains activated.
Whether has been programmed the automatic execution of program P2 and manually, through the interface panel, is changed the program, the selected program remains active until when will start the new automatic execution.
In the following paragraphs the functioning mode is described generically, the effective action will behave depending on the active parameter (of program P1 or P2).

4.5 - OUTPUTS CONFIGURATION
The system has a maximum of 8 outputs to control the loads. These loads can be compressors or multistage electrovalves whenever is controlled pressure/temperature of suction or ventilators whenever is controlled pressure/temperature of condensing (regulator 1), or again a whole of compressors (and electrovalves) and fans whenever is controlled whether a process of condensing (regulator 1) or suction (regulator 2).
The parameters involved in the outputs configuration are :
<u>for regulator 1:</u>
"nC" - Compressors number (or fans in case are controlled just fans)
"S1" - steps number for compressor n.1
"S2" - steps number for compressor n.2
"S3" - steps number for compressor n.3
"S4" - steps number for compressor n.4
"S5" - steps number for compressor n.5
"S6" - steps number for compressor n.6
"S7" - steps number for compressor n.7
"S8" - steps number for compressor n.8
<u>for regulator 2:</u>
"nF" - fans number (if are controlled compressors and fans)
As the control outputs available are 8, during the programming it's necessary to verify the following condition :

S1+S2+S3+S4+S5+S6+S7+S8+nF $\leq$ 8

As regard regulator 1, in case of multistage compressors , it has to be reminded that they are formed by one output to drive the motor and by one or more outputs to drive the multistage electrovalves and therefore the output which drives the motor has to be assigned as the first in the numeric order in respect of the electrovalves.
The output driving the motor will be always activated before the relative electrovalves and switched off after them.
Furthermore, it has to be underlined that the compressor with more stages have to be obligatory connected to the first outputs (OUT1, OUT2 ecc.).
In case of compressors and fans control, the first outputs are dedicated to control the compressors (regulator 1) and the lasts to control the fans (regulator 2).

Anyway, in order to make this matter easily comprehensible, herewith we report two configuration examples.

CONFIGURATION EXAMPLE n.1

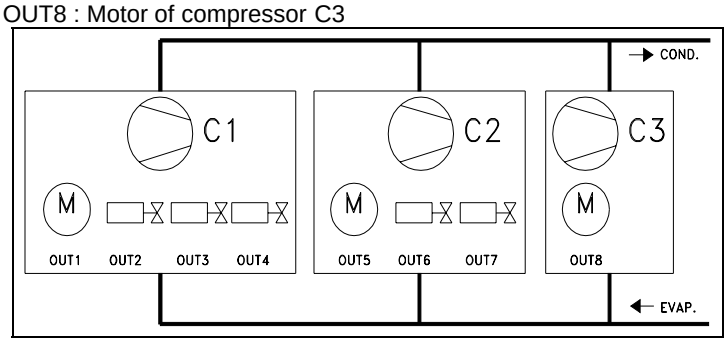
For example, it's desired to control the suction pressure of a plant through the control of the following compressors :

C1) compressor with 4 stages
C2) compressor with 3 stages
C3) compressor without stages

As it's desired just to control the suction, the instrument will use only one input (INA1) which measures the pressure (or the temperature) of suction.

Following the principle for which the compressors with more stages have to be connected to the first outputs it comes that the outputs will control then respectively :

OUT1 : Motor of compressor C1 (1st step)
OUT2 : Electrovalve C1 2nd step
OUT3 : Electrovalve C1 3rd step
OUT4 : Electrovalve C1 4th step
OUT5 : Motor of compressor C2 (1st step)
OUT6 : Electrovalve C1 2nd step
OUT7 : Electrovalve C1 3rd step
OUT8 : Motor of compressor C3



The parameters programming will be the following :

"nC" = 3	"S1" = 4	"S2" = 3	"S3" = 1
"S4" = 0	"S5" = 0	"S6" = 0	"S7" = 0
"S8" = 0	"nF" (if present) = 0		

CONFIGURATION EXAMPLE n.2

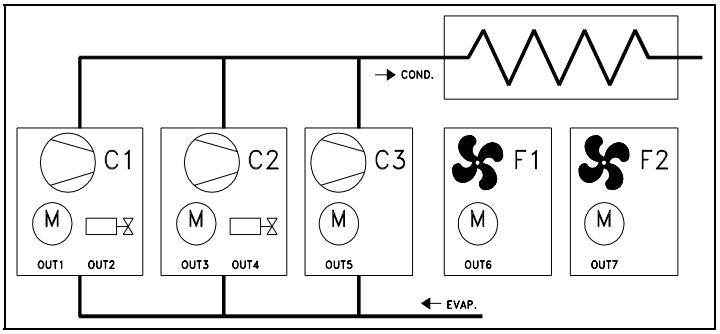
For example, it's desired to control the suction pressure of a plant through the control of the following compressors :

C1) compressor with 2 stages
C2) compressor with 2 stages
C3) compressor with 1 stages

and also it's desired to control the condensing pressure by means of 2 fans (F1, F2). As it's desired to control both suction and condensing the instrument should be equipped with one input (INA1) which measures the pressure (or the temperature) of suction and with one input (INA2) which measures the pressure (or the temperature) of condensing.

Following the principle for which the compressors with more stages have to be connected to the first outputs and that the first outputs always control the compressors (whether are controlled the fans as well) it comes that the outputs will drive then respectively:

OUT1 : Motor of compressor C1 (1st step)
OUT2 : Electrovalve C1 2nd step
OUT3 : Motor of compressor C2 (1st step)
OUT4 : Electrovalve C2 2nd step
OUT5 : Motor of compressor C3
OUT6 : Motor of fan F1
OUT7 : Motor of fan F2
OUT8 : Not used



The parameters programming will be the following :

"nC" = 3	"S1" = 2	"S2" = 2	"S3" = 1
"S4" = 0	"S5" = 0	"S6" = 0	"S7" = 0
"S8" = 0	"nF" = 2		

4.6 - VISUALISATION OF THE COMPRESSORS RUNNING HOURS

The instrument is able to store the total running hours of the compressor motors or fans controlled.

Pushing and releasing key HRS the display will show **"hc"** and the running hours (/10 - i.e. the tens of the hours) of the first motor, signaled by the flashing of the output led which is driving it (surely OUT1).

Now, pushing key UP, the display visualises the running hours (tens) of the second motor, signaled by the flashing of the output led which is driving it, and so on for all the motors controlled.

To avoid confusion, on this modality, all the led relative to the other actuator control outputs are switched off.

The instrument stores up to 9999 (0) running hours for each output (i.e. about 11 years of uninterrupted functioning) after which it's automatically erased, starting again from 0.

Whenever is desired to manually erase the different counters (because the compressor has been substituted, a maintenance operation has been done, the control system is mounted on a new plant, etc.) it's possible to do it keeping pushed key HRS for 5 sec. during the visualisation of the compressor running mode, the display will show 0000 flashing to indicate that the counter is nearly to be erased.

To erase it then, push within 5 sec., key DOWN keeping it pushed for 5 sec. and the counter will be effectively erased.

Obviously, keeping the key pushed for a time minor then 5 sec. the counter is not erased. After 5 sec. of inactivity of the keys , the display comes back to the normal functioning mode.

The running hours storage is always active, anyway the instrument is able to keep in memory the number of the functioning hours also without power supply only if it's present the internal clock.

If the internal clock is not present, in case of power failure, the counters are erased.

4.7 - CONTROL ACTION

The instrument can be equipped with up to 2 regulators (regulator 1 and 2).

Regulator 1 has the possibility to manage compressors (also multistage) or fans when is present only the input INA1.

When are instead present both inputs INA1 and INA2 the regulator 1 will manage the compressors and regulator 2 the fans.

The control outputs driven by the instrument intervene with ON/OFF action, ON/OFF with Neutral Zone action or PROPORTIONAL action, depending on what programmed on par. :

"C1" - Control type of regulator 1
on - ON/OFF
nr - Neutral Zone
Pr - Proportional
e similarly
"C2" - Control type of regulator 2

The ON/OFF control is the simplest type and it's used when it's not necessary to avoid loads "short cycles" and it's not then particularly suitable to control motors; it can be used for other particular cases.

The NEUTRAL ZONE control is used when there are few compressors with a high power and its' necessary to avoid, as much as possible, loads "short cycles", but this is prejudicial to the accuracy of the process value.

The PROPORTIONAL control instead is used when there are many compressors (or steps) and it's desired to maintain as much constant as possible the process value, but this is prejudicial to possible frequent "short cycles" of the actuators.

The regulators, are furthermore working with direct or reverse action, depending on what programmed on par. :

"1A" - Action type of regulator 1:

C1 - Direct Action with probe INA1 on the suction side : at the increasing of the process value, the outputs are activated

C2 -Direct Action with probe INA1 on the condensing side: at the increasing of the process value, the outputs are activated

H1 - Reverse Action with probe INA1 on the suction side : at the increasing of the process value, the outputs are deactivated

H2 - Reverse Action with probe INA1 on the condensing side : at the increasing of the process value, the outputs are deactivated and similarly

"2A" - Action type of regulator 2:

C - Direct Action : at the increasing of the process value, the outputs are activated

H - Reverse Action : at the increasing of the process value, the outputs are deactivated

Anyway, these parameters will probably not be used for the refrigeration applications, as these types of control normally require direct actions (C)

4.8 - POWER CONTROLLED BY THE OUTPUTS

For different reasons (outputs state in case of probe error, proportional control or gradual insertion of the power) it's indispensable to program on par. **"P1 ... P8"** a number (from 0 to 999) which defines a proportion between the powers or the flows controlled by the different outputs.

Obviously the fitter should know a common parameter (Power expressed in KW or CV or the flow or something else).

For example, whether are used 5 compressors with the following features :

The first of 10 KW multistage with 2 steps of equal flow (driven by OUT1, OUT2)

The second of 5 KW not multistage (driven by OUT3)

The third of 5 KW not multistage (driven by OUT4)

The fourth 2 KW not multistage (driven by OUT5)

The fifth da 2 KW not multistage (driven by OUT6)

the parameters have to be programmed in this way :

"P1" = 5	"P2" = 5	"P3" = 5	"P4" = 5
"P5" = 2	"P6" = 2	"P7" = 0	"P8" = 0

As P1 + P2 + P3 + P4 + P5 + P6 + P7 + P8 = 100 % of the power = in our case it's 24

the controller will be then able to calculate the power controlled by the different outputs :

OUT 1 = 100 * 5 / 24 = 20,83 % OUT 2 = 100 * 5 / 24 = 20,83 %

OUT 3 = 100 * 5 / 24 = 20,83 % OUT 4 = 100 * 5 / 24 = 20,83 %

OUT 5 = 100 * 2 / 24 = 8,33 % OUT 6 = 100 * 2 / 24 = 8,33 %

OUT 7 = 0 % (not used) OUT 8 = 0 % (not used)

As regard the outputs controlling the fans, in the configuration with 2 input probes, the power of the single fans has to be considered always equal and therefore it's not necessary to program the power value.

For example, whether the fans controlled are 4, each one controls the 25% of the power.

4.9 - VISUALISATION OF THE POWER SUPPLIED TO THE PLANT

It's possible to visualise the power supplied by the controller to the plant (i.e. the powers sum of the outputs working on that moment, relatives to the regulator) with the following modality :

- pushing for 3 sec. key "UP", in the normal visualisation mode, the display will show **"PP"** and the power supplied on that moment by regulator 1.
- pushing for 3 sec. key "DOWN", in the normal visualisation mode, the display will show **"PF"** and the power supplied on that moment by regulator 2.

After 5 sec, the display will come back to the normal functioning mode.

4.10 - ON/OFF CONTROL

The ON/OFF control mode ("C1" or "C2" = on) works on the outputs, depending on the process value (INA1 for regulator 1 and INA2 for regulator 2), on the programmed Set point (**"SP"** for regulator 1 and **"SF"** for regulator 2) , on the hysteresis (**"d1"** for regulator 1 and **"d2"** for regulator 2), on the programmed shift of the hysteresis band or manual reset (**"r1"** for regulator 1 and **"r2"** for regulator 2) and obviously on the action which it has to execute (**"A1"** for regulator 1 and **"A2"** for regulator 2).

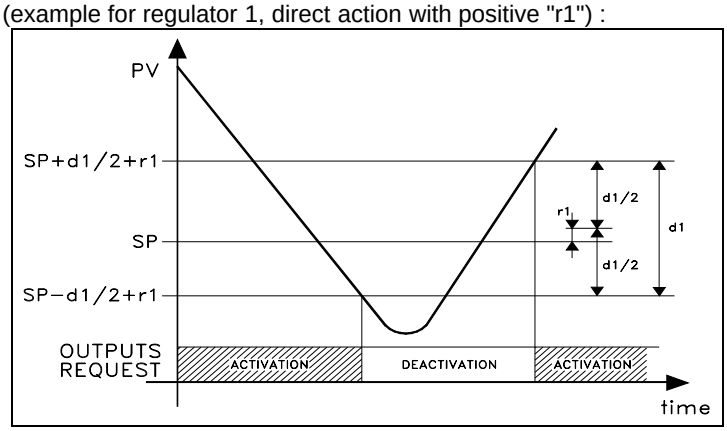
The unit of measurement of the programmed values will be then as selected on par. "nU" and the shift of the hysteresis band or manual reset is intended as offset of the hysteresis band in comparison to the Set Point.

Therefore, to make an example, with direct action, the regulator 1 :

- will provide to activate the outputs when the process value is higher than [SP - d1/2 + r1].

-will provide to deactivate the outputs when the process value is lower than [SP + d1/2 + r1].

The functioning can be explained as in the following drawing (example for regulator 1, direct action with positive "r1") :



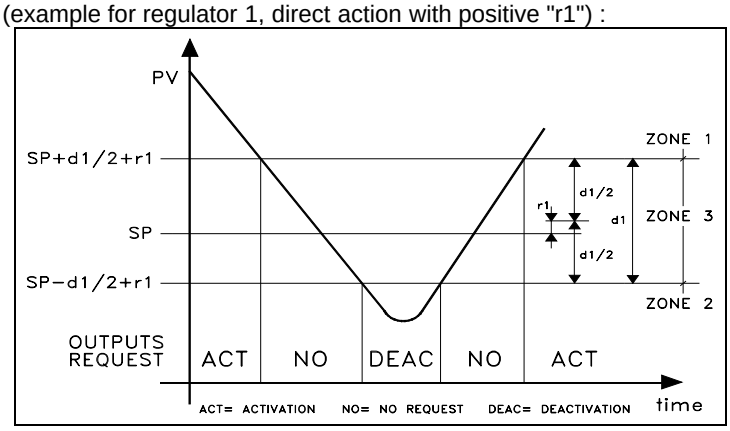
This type of control is extremely simple, but requires the continuous activation / deactivation of the outputs and it's not then advisable if it's necessary to avoid frequent switch on/off ; it could be used for other particular cases.

4.11 - NEUTRAL ZONE CONTROL

The NEUTRAL ZONE control ("C1" or "C2" = nr) is very similar to the ON/OFF control type and it works on the outputs depending on the process value (INA1 for regulator 1 and INA2 for regulator 2), on the programmed Set point (**"SP"** for regulator 1 and **"SF"** for regulator 2) , on the hysteresis (**"d1"** for regulator 1 and **"d2"** for regulator 2), on the programmed shift of the hysteresis band or manual reset (**"r1"** for regulator 1 and **"r2"** for regulator 2) and obviously on the action which it has to execute (**"A1"** for regulator 1 and **"A2"** for regulator 2).

The unit of measurement of the programmed values will be then as selected on par. "nU" and the shift of the hysteresis band or manual reset is intended as offset of the hysteresis band in comparison to the Set Point.

The functioning can be explained as in the following drawing (example for regulator 1, direct action with positive "r1") :



Zone 1 - the regulator will provide to activate the outputs when the process value is higher than [SP + d1/2 + r1]

Zone 2 -the regulator will provide to deactivate the outputs when the process value is lower than [SP - d1/2 + r1].

Zone 3 -the regulator will provide instead, at the inside of the band [SP + d1/2 + r1] ... [SP - d1/2 + r1], to maintain the outputs at the same state they had at the moment of the process value intervention on the band.

With this system (differently from the ON/OFF one) it's very probable that the outputs activation / deactivation are less frequent because, after one or some oscillations, after that the process value is at the inside of the hysteresis band and the load of the plant is constant, there shouldn't be the necessity of outputs activation or deactivation.

Therefore, as already explained, the NEUTRAL ZONE control is used when there are few compressors with a high power and its' necessary to avoid, as much as possible, frequent switch on/off, but this is prejudicial to the accuracy of the process value.

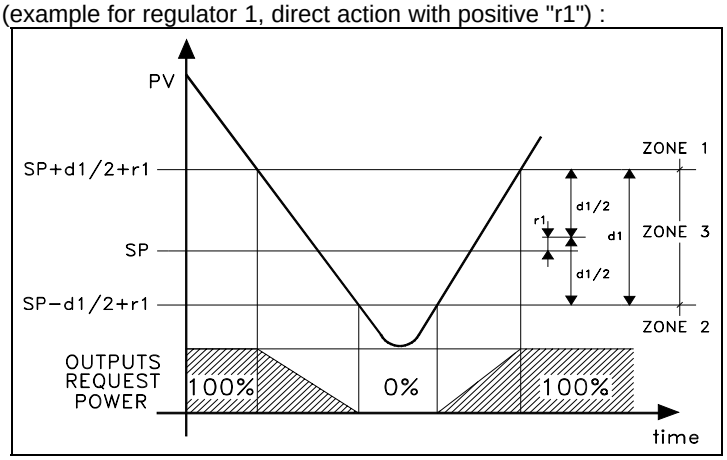
4.12 - PROPORTIONAL CONTROL

The Proportional control ("C1" or "C2" = Pr) works on the outputs depending on the process value (INA1 for regulator 1 and INA2 for regulator 2), on the programmed Set point (**"SP"** for regulator 1 and **"SF"** for regulator 2) , on the hysteresis (**"d1"** for regulator 1 and **"d2"** for regulator 2), on the programmed shift of the hysteresis band or manual reset (**"r1"** for regulator 1 and **"r2"** for regulator 2) and obviously on the action which it has to execute (**"A1"** for regulator 1 and **"A2"** for regulator 2).

With this type of control it's absolutely necessary that the controller knows the power percentage controlled by the different outputs, in order to supply to the plant only the effective power required by the proportional controller.

The proportional controller behaves exactly as the Neutral Zone controller when the process variable is located in Zones 1 or 2 (requiring then the outputs activation or deactivation, i.e. supplying to the plant the 100% or 0% of the power) while in Zone 3 (i.e. at the internal of the proportional band) it will not maintain the outputs deactivated as in the Neutral Zone control, but it will supply the power depending on the shift [Process Value - Set Point].

The functioning can be explained as in the following drawing (example for regulator 1, direct action with positive "r1") :



The regulator, after the exact calculation of the power to be given, will provide to activate the outputs, allowing the supply of power , as near as possible to what required.

Therefore, as already explained, the PROPORTIONAL control is used when there are many compressors (or steps) and it's desired to maintain as much constant as possible the process value, but this is prejudicial to possible frequent switch on/off of the actuators.

4.13 - SWITCH ON / OFF PRIORITY OF THE LOADS

Before that the internal regulator (1 or 2) has decided whether it's necessary to switch on or off the actuators, it's obligatory that the controller verifies the configuration, in order to defines the possible combinations and successively it has to consider the following conditions.

SWITCH ON / OFF PRIORITY OF THE LOADS IN CASE OF MULTISTAGE COMPRESSORS

As already told, in case of multistage compressors (i.e. only for regulator 1) it's necessary that all the outputs driving the motors are being activated before than the outputs driving the relative multistage valves and, when these are all switched off, to switch off the relative motor.

Furthermore, once one motor is switched on, before than switch on all the others, it's necessary to activate all the relative multistage valves of that motor, in order to avoid the functioning of all the motors not working full load.

As regard the motors switching on, it could be advisable (with equal power for the proportional regulator), instead of switching off the whole plant, to keep the motor working and switch off the valve of another plant, in order to have, in case of an activation request, always available a valve instead of a motor, so to avoid motor switching on.

Otherwise, could be also advisable (still with equal power) to switch off the whole plant, because it's foreseen not to have immediate activation requests (for instance in case of night functioning) so to obtain an energetic saving.

Summing up:

- To switch on a motor instead of a valve means to save the energy used by the motor, but it has to be reminded that, at the successive power request, the regulator will be obliged to switch on the motor (not saving then the number of activation)
- To switch off a valve instead of a motor means to save a motor activation, because at the successive power request, the regulator actives the valve instead of the motor (not saving then the energy used by the motor).

"ES" : Saving of motors functioning with parzializzazione regulator 1

oF = Valves switching off priority (activation saving)
on = Motors switching off priority (energetic saving)

This parameter is obviously uninfluential whether there are no parzializzati compressors (all parameters S1, S2, S3 etc. are = 1 or 0)

SWITCH ON / OFF PRIORITY OF THE LOADS IN CASE OF PROGRESSIVE POWER ACTUATION

It's active only for regulator 1 (regulator 2 has always equal powers) when there are no multistages loads.

This function allows, with ON/OFF control, to avoid too high increases or decreases when the process variable is next to the intervention values (permitting a better process stabilization particularly with Neutral Zone control) and, in case of proportional control, it allows to active the power effectively required (having obviously different powers driven by the outputs) not considering frequent switching on and off.

The function is actionable through par.:

"PS " - Switch on / off priority in case of progressive power actuation

on - In case of switch on / off request, the regulator provides to active / deactive the outputs, in order to obtain the combination which allows to add/subtract the lowest power to the plant.

Then, if the switching on / off request still remains, the regulator provides to add/subtract the lowest possible power, although to do this it's necessary to switch off and successively switch on the outputs.

oF - The switching on / off considers only the outputs available to be activated / deactivated which has the lowest power and doesn't consider all the possible combinations, avoiding in this way to switch off and on different outputs.

In the practice, anyway, if the powers controlled by the outputs are all equal the parameter has no influence on the switching on / off priority.

In case of multistage compressors with any kind of control type and obviously with different powers, the switching on / off priority is always established starting from the lower power available, but it's excluded the functioning described on par. "PS"=on, because the activation of this combination could requires too many operations and then too much time to be executed, as it has necessarely to be respected the conditions which permit not to have all the motors working not full load.

SWITCH ON / OFF PRIORITY OF THE LOADS IN CASE OF FUNCTIONING HOURS (LOADS ROTATION)

It's active in all the conditions and permits to make equal, as much as possible, the functioning hours of the different motors through the parameters :

"1r": Loads rotations with functioning hours - regulator 1
"2r": Loads rotations with functioning hours - regulator 2

on = Active rotation

Whenever it's required an activation, with equal power request, it's switched on the output driving a motor with less functioning hour and, whenever it's required a switching off, it's switched off the one presenting a higher number of functioning hours.

In case of equal power and equal functioning hours, anyway, it's not activated the last output switched on or deactivated the last one switched on.

oF = Fix sequence of switching on

It's allows the switch on priority of the first output with a numerical order (Out1, Out2, etc.) and the switch off priority of the last output activated.
At the conditions under which, obviously, being the powers different, there is no priority of power; in this case will be activated / deactivated the output which has lower power.
When par. "1r" or "2r" are = on , to avoid an eccessive want of balance of the functioning between the different compressors, through par.
"Hh" : Maximum continuous functioning of a motor
it's possible to program the maximum number of continuous functioning hours of a motor, at the elapsing of which the controller provides, after have verified that it's available another motor to be switched on (or plant if the compressor is multistages) of the same power, to switch off the motor which is working and to switch on the other one available.

4.14 - DELAY TIME OF THE OUTPUT ACTIVATION / DEACTIVATION (PROTECTION TIMES)

These delay times, also called protection times, are mainly used to avoid compressors "short cycles" and, generally, to avoid "short cycles" of the uses controlled.
The outputs activation anyway is never contemporary, but it's always sequential with a minimum interval of 1 sec. between a switch on (or switch off) and the successive one. (times "t4" and "t5").
The only exception is when the control is concerning whether compressors or fans (i.e. are present and activated both regulators), in this case the action of the two regulators have to be indipendent and consequently the action of a compressor and a fan can be contemporary.
So, once decided if active or deactive the outputs and with which priority, the regulator will verify the conditions programmed through the protection times, which are:
"t1" - Minimum time between switch on of the same compressor or delay between the different switch on (in min.)
"t2" - Minimum time between switch off and switch on of the same compressor or delay after switch off (in min.)
Times “t1” and “t2” work only on the output driving the compressors motors (individualizable by the configuration) and then regard only regulator 1.
"t3" - Minimum functioning time of an output (in sec.). Since is activated, an output works for the programmed time, although the activation request is finished.
"t4" - Delay time between successive switch on, of two different outputs (in sec.) Delay, starting from an output activation up to the activation of the successive one.
"t5" - Delay time between successive switch off, of two different outputs (in sec.) Delay, starting from an output deactivation up to the deactivation of the successive one.
Times “t3”, “t4”, “t5” work, instead, always on all outputs indipendently by the driving of motors or multistage valves.
Whenever the regulator requires the output activation or deactivation, but this one is inhibited by one of the protection times, the led relative to the output will flash.

4.15 - OUTPUT DEACTIVATION FOR MAINTENANCE

It's possible to inhibit (deactive) the outputs, in order to effect maintenance operations or for other reasons, with the following procedure:
Push and release key "MAINT", the display will visualise **"nt"** and the availability state (on or oF) of the first output signalled also by the flashing of led relative to the output.
To avoid confusion, in this modality, all led, relative to the other outputs driving the actuators, are in any case switched off.
Now, pushing key UP, the display visualises the availability state of the second output, signalled obviously by the relative led, and so on for all the outputs activated by the configuration.
After the selection of the output whom availability state has to be modified, push and keep pushed for 5 sec. key "MAINT", the display will switch from on to oF or vice versa depending on the previous state.
After 5 sec. of keys inactivity the display comes back to the normal functioning mode.
To switch an output, which drives a motor, into the maintenance state, means to deactive also its multistage valves outputs (although the outputs availability state is not changed; this in order to avoid that, at the restoration of the output functioning, it's not necessary to restore also the connected outputs).
When an output is into the maintenance state (availability oF), during the normal visualisation, the led relative to the output is flashing rapidly to signal the unavailability of that output.

4.16 - ALARM FUNCTIONS

TDC operator interface is equipped with an alarm output ALARM which is used : as alarm signalling for probes error, as high and low temperature alarms, as outputs alarms, as external alarm and as running hours alarm.
Furthermore, TDP unit is equipped with an internal buzzer which signalise the alarm condition and with a led ALARM which indicates the active alarm state (switched on, fixed) or silenced (flashing slowly) or in memory (flashing rapidly).
When the alarm is activated, to silence the buzzer it's necessary to push key ALARM MUTE.
Here following are described all the alarm conditions; in case of alarm function for probes errors, see paragraph relative to error signalling.
Whenever are present contemporarily several alarm conditions, the display will show alternatively the labels referred to the alarm conditions and the process value of INA1.

4.16.1 - LOW AND HIGH ALARMS

Low and high alarm function works depending on the following parameters :
"o1" - High alarm Set for regulator 1 (relative to Set point "SP")
"u1" - Low alarm Set for regulator 1 (relative to Set point "SP")
"o2" - High alarm Set for regulator 2 (relative to Set point "SF")
"u2" - Low alarm Set for regulator 2 (relative to Set point "SF")
"1d" - High and Low alarms differential for regulator 1
"2d" - High and Low alarms differential for regulator 2
"rA" - High and Low alarms delay (in sec.)
"PA" - High and Low alarms delay time from switch on
This delay is active only if, at the switch on, the instrument is into alarm conditions of the process value and it's then erased when the instrument is not into alarm conditions of the process value.
The alarm relative to regulator 1 is ready at the end of the “PA” delay time and it's activated when the process value INA1 is higher than value [SP + o1] or is lower than value [SP - u1] for the time programmed on par. "rA".
Similarly is the behaviour of the alarm for regulator 2, which is ready at the end of the “PA” delay time and it's activated when the process value INA2 is higher than value [SF + o2] or is lower than value [SF - u2] for the time programmed on par. "rA".
Obviously the unit of measurement of high and low alarms is the same of the set point and it's defined through par. "nU".
High and low alarms can be deactivated programming the relative parameters = 0.
Contemporarily to the alarm signal, although the buzzer is silenced, the panel TDP indicates the alarm by switching on the led ALARM and visalises on the display D2 :
- Alternatively **"H1"** and the process value, in case of high alarm for input INA1
- Alternatively **"L1"** and the process value, in case of low alarm for input INA1
- Alternatively **"H2"** and the process value in case of high alarm for input INA2
- Alternatively **"L2"** and the process value in case of low alarm for input INA2

The high and low alarms intervention do not cause any action on the occurring control operations.

4.16.2 - OUTPUTS ALARMS

Through the digital inputs ALARM OUT 1 ... ALARM OUT 8 it's possible to deactive the outputs and to obtain the alarm intervention. The output is inhibited by the digital input intervention, depending on what programmed on par.:

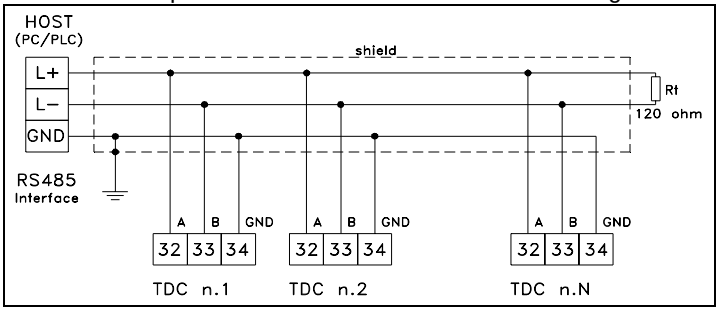
"oL" : Logic of activation for the input driving the outputs alarm (on - oF) and then for the closing (on) or the opening (oF) of the digital input.
The input intervention, immediately inhibits the corresponding output and activates the output and the alarm signal.
Contemporarily to the alarm signal, although the buzzer is silenced, the panel TDP indicates the alarm by switching on the led ALARM and visalises on the display :
- Alternatively **"A1"** (**"A2", "A3"** etc. depending on the output in alarm state) and the prrocess value INA1.
When an output is into the alarm state, during the normal visualisation, the led relative to the output is flashing rapidly to indicate the alarm condition and the unavailability of that output.
The alarm of an output driving a motor deactivates consequently also its multistage valves outputs.

4.16.3 - GENERIC EXTERNAL ALARM
The generic external alarm is activated by the intervention of the digital inputs external alarm (ALARM GEN.) depending on the logic of activation programmed on parameter :
"LI" : Logic of activation for the external alarm input (on - oF)
for the time programmed on parameter :
"ti" : External alarm delay (in sec.)
Contemporarily to the alarm signalling, although the buzzer is silenced, TDP panel signalises the alarm by switching on led ALARM and showing on the display :
- Alternatively **"AL"** and the process value
The intervention of the external alarm does not cause any action on the other outputs.

4.16.4 - FUNCTIONING HOURS ALARM
If one of the motor reaches the number of hours programmed on par.:
"Ah": Functioning hours alarm of the motors (in tens of hours)
the instrument actives the alarm and visualises on the display :
- Alternatively **"F1"** (**"F2", "F3"** etc. depending on the output driving the motor which has reached the number of hours programmed) and the process value.
The alarm has the only meaning to signalise an eventual maintenance intervention and therefore the corresponding control output is not deactivated.
To restore the alarm it's necessary to reprogram the counter of the relative motor, or to increase the value of par. "Ah" or program it as 0 (the alarm function is deactivated).
If , instead, the control is not equipped with internal clock it's enough to switch off the power supply (the motor counters are then restored).
The function is inhibited if the par. “Ah” is = 0.

4 4.16.5 - ALARMS MEMORY
The instrument offers furthermore, through parameter :
"tA" - Alarms memory
the possibility to store the last alarms signalling (on) or not (oF). So, if "tA" is programmed as "oF" the instrument erases the alarm signalling at the end of the alarm conditions; instead, if the parameter is programmed as "on" at the end of the alarm, the instrument stores the alarm and maintain the led ALARM rapidly flashing, in order to indicate that an alarm occurred.
If the instrument is equipped with the internal clock it's possible to store, in addition to the alarm type, also the day and hour of the happening, the day and hour in which the alarm is finished and if the alarm has been silenced or not.
If instead, the instrument has no internal clock, the alarms are stored without indication of day and hour.
When the led ALARM is rapidly flashing indicating that an alarm has been stored, pushing key ALARM MUTE, the 2 figures display will show for 10 sec. the code of the last alarm occurred and stored (L1, AL, etc.) while the 4 figures display will show alternatively "ondx" (where x is the day of the week of the alarm occurring) and the hour of the alarm event.
Pushing key DOWN within 10 sec., the 2 figures display will still show the alarm code while the 4 figures display will show alternatively "oFdx" (where x is the day of the week of the alarm ending) and the hour of the alarm ending.
Pushing again, within 10 sec., key DOWN the displays will show, with the same modalities, the last but one alarm stored (first when it began and then when it finished)
During these visualisations led ALARM is flashing slowly if that alarm has been silenced or it’s flashing rapidly whether it has not been silenced, and so on until the display will show all the alarms stored in the last week (maximum 20).
With this modality it is possible, pushing key UP, to run over all the alarms stored also backwards up to the last one.
Not pushing any key for 10 sec. the display will come back to the normal conditions, so as led ALARM which will erase then all the alarm memory signalling (i.e. no more flashing rapidly).
If the instrument is not equipped with the clock the modality are the same, but it's not present the indication of day and hour.
Whenever is not present the alarm memory signalling and it's desired to accede to the visualisation of the stored alarms it's possible to do it pushing and keeping pushed, for 3 sec. at least, key ALARM MUTE.
The display will show the last alarm stored ; with keys UP and DOWN it will be possible to run over the different alarms, as already described, with the addition of the active alarms on that moment, signalised by led ALARM switched on fixedly and with the visualisation of the day and hour of alarm beginning, while the day and hour of the alarm ending are substituted by the word **"Act"** (the same thing will happen also if the clock is not present with the exception of day and hour.).
The output from the stored alarms mode will occur after 10 sec. of the keys inactivity.
If the instrument is not equipped with the clock, are remaining stored the last 20 alarms events; if, instead, it's equipped with the clock are remaining stored maximum the last 20 alarms occurred in the last week.
The alarms stored are erased only in case of power failure, while if the instrument is turned into stand-by mode they remain stored.

4.17 - RS 485 SERIAL INTERFACE
The instrument can be equipped with an optoisolated RS 485 serial communication interface, by means of which it's possible to connect the regulator with a net on which are connected other instruments (regulators or PLC) all depending typically on a personal computer used as plant supervisor.
Through the personal computer it's possible to acquire all the functioning information and to program all the instrument configuration parameters.
The software protocol adopted for TDC series is a derivative from MODBUS RTU or JBUS protocol (AEG Schneider Automation, Inc. Trade Mark) widely used in several PLC and supervision programs available on the market (TDC series protocol manual is available on request).
The interface circuit allows to connect up to 32 TDC instruments on the same line.
To maintain the line on rest conditions it's required the connection with a 120 Ohm resistance (Rt) at the end of the line.
The instrument is equipped with two terminals called A(L+) and B(L-) that have to be connected with all the namesake terminals of the net.
For the wiring operation it's enough then to interlace a double cable (telephonic type) and to connect on ground all the GND terminals.
Anyway, particularly when the net results very long or noised and being present potential differences between the GND terminals it's advisable to adopt a shielded cable wired as in the drawing.



Adopting this electrical drawing and having care that the total capacity of the line would not be higher than 200 nF, the total length of the line can reach a maximum of 1500 meters.
If the instrument is equipped with the serial interface, the parameters to be programmed are the following :
"dn" : Address of the station. Program a different number for each station, from 1 to 255.
"br" : Transmission speed (baud-rate), programmable as 0 (1200 baud), 1 (2400 baud), 2 (4800 baud), 3 (9600 baud).
All the stations have to be the same transmission speed.
"SE" : Programming access. If programmed as "L-" this means that the instrument is programmable only from the keyboard, if programmed as "Lr" it's programmable both from the keyboard and serial line and if programmed as "r-" this means that the instrument is programmable only from serial line.
In this last case or if is having place a communication through the RS485 serial port, if it's tried to get into the programming on the display will appear **"buSy"** to indicate that the access is denied.

5 - PROGRAMMABLE PARAMETERS

Here following are described all the instrument parameters; pls. note that some of them could do not appear or because are according to the kind of used instrument or because are automatically disable, because they're not necessary.

5.1 - PARAMETERS TABLE

Par.			Description	Range	Def.	Note
MEASUREMENT AND VISUALISATION						
1		**C1**	Probe INA1 Calibration	-9.99 ... 99.99	0.00	
2		**C2**	Probe INA2 Calibration	-9.99 ... 99.99	0.00	
3		**2P**	Probe INA2 Presence	on - oF	on	
4		**nU**	Unit of measurement for normal visualisation and programming	PP - Pt - tP - tt	PP - tt	
5		**ru**	Temperature unit of measurement	C - F	C	
6		**dP**	Display resolution	L - H	H	
7		**1S**	Beginning scale of input INA1 for normalised signals	0 - n0	n0	
8		**1L**	Lower limit of input INA1 for normalised signals	-99.9 ... 999.9	-0.5	
9		**1H**	Higher limit of input INA1 for normalised signals	-99.9 ... 999.9	7.0	
10		**2S**	Beginning scale of input INA2 for normalised signals	0 - n0	n0	
11		**2L**	Lower limit of input INA2 for normalised signals	-99.9 ... 999.9	0.0	
12		**2H**	Higher limit of input INA2 for normalised signals	-99.9 ... 999.9	30.0	
13		**rt**	Refrigerating gas used	0 ... 12	0	
OUTPUTS CONFIGURATION						
15		**nC**	Motors number (compressors) (regul. 1)	1 ... 8	8	
16		**S1**	Steps number for compressor 1 (regul. 1)	1 ... 8	1	
17		**S2**	Steps number for compressor 2 (regul. 1)	0 ... 4	1	
18		**S3**	Steps number for compressor 3 (regul. 1)	0 ... 2	1	
19		**S4**	Steps number for compressor 4 (regul. 1)	0 ...2	1	
20		**S5**	Steps number for compressor 5 (regul. 1)	0 - 1	1	
21		**S6**	Steps number for compressor 6 (regul. 1)	0 - 1	1	
22		**S7**	Steps number for compressor 7 (regul. 1)	0 - 1	1	
23		**S8**	Steps number for compressor 8 (regul. 1)	0 - 1	1	
24		**nF**	Fans number(regul. 2)	0 ... 7	0	
25		**P1**	Power controlled by output Out 1 (regul. 1)	0 ... 999	1	
26		**P2**	Power controlled by output Out 2 (regul. 1)	0 ... 999	1	
27		**P3**	Power controlled by output Out 3 (regul. 1)	0 ... 999	1	
28		**P4**	Power controlled by output Out 4 (regul. 1)	0 ... 999	1	
29		**P5**	Power controlled by output Out 5 (regul. 1)	0 ... 999	1	
30		**P6**	Power controlled by output Out 6 (regul. 1)	0 ... 999	1	
31		**P7**	Power controlled by output Out 7 (regul. 1)	0 ... 999	1	
32		**P8**	Power controlled by output Out 8 (regul. 1)	0 ... 999	1	
PARAMETERS REGULATOR 1						
33	**P1**	**1C**	Control type of regul. 1	on - nr - Pr	nr	
34	**P2**	**1C**	Control type of regul. 1	on - nr - Pr	nr	
35		**1A**	Action type of regul. 1	H1-H2- C1-C2	C1	
36	**P1**	**d1**	Hysteresis band (ON/OFF control) or Proportional Band (prop. control) regul. 1	0.00 ... 99.99	2.00	
37	**P2**	**d1**	Hysteresis band (ON/OFF control) or Proportional Band (prop. control) regul. 1	0.00 ... 99.99	2.00	
38	**P1**	**r1**	Manual reset regul. 1	-d1/2 ... d1/2	0.00	
39	**P2**	**r1**	Manual reset regul. 1	-d1/2 ... d1/2	0.00	
40	**P1**	**L1**	Low set regul. 1	-99.9...H1	-50.0	
41	**P2**	**L1**	Low set regul. 1	-99.9...H1	-50.0	
42	**P1**	**H1**	High set regul. 1	L1... 999.9	50.0	
43	**P2**	**H1**	High set regul. 1	L1... 999.9	50.0	
44		**E1**	Outputs state regul.1 in error conditions, with probe INA1	0 - 1 - 2	0	
45	**P1**	**F1**	Power to be supplied as output in case of INA1 error	0 ... 100 %	0	
46	**P2**	**F1**	Power to be supplied as output in case of INA1 error	0 ... 100 %	0	
PARAMETRI REGOLATORE 2						
47	**P1**	**2C**	Control type of regul. 2	on - nr - Pr	nr	
48	**P2**	**2C**	Control type of regul. 2	on - nr - Pr	nr	
49		**2A**	Action type of regul. 2	H - C	C	
50	**P1**	**d2**	Hysteresis band (ON/OFF control) or Proportional Band (prop. control) regul. 2	0.00 ... 99.99	2.00	
51	**P2**	**d2**	Hysteresis band (ON/OFF control) or Proportional Band (prop. control) regul. 2	0.00 ... 99.99	2.00	
52	**P1**	**r2**	Manual reset regul. 2	-d2/2 ... d2/2	0.00	
53	**P2**	**r2**	Manual reset regul. 2	-d2/2 ... d2/2	0.00	
54	**P1**	**L2**	Minimum set regul. 2	-99.9...H2	-50.0	
55	**P2**	**L2**	Minimum set regul. 2	-99.9...H2	-50.0	
56	**P1**	**H2**	Maximum set regul. 2	L2... 999.9	50.0	
57	**P2**	**H2**	Maximum set regul. 2	L2... 999.9	50.0	
58		**E2**	Outputs state regul.2 in error conditions, with probe INA2	0 - 1 - 2	0	
59	**P1**	**F2**	Power to be supplied as output in case of INA2 error	0 ... 100 %	0	
60	**P2**	**F2**	Power to be supplied as output in case of INA2 error	0 ... 100 %	0	

SWITCH ON / OFF PRIORITY						
61	**P1**	**ES**	Saving of motors functioning for regul. 1	oF - on	oF	
62	**P2**	**ES**	Saving of motors functioning for regul. 1	oF - on	oF	
63		**PS**	Switch on/off priority in case of progressive power actuation regul. 1	oF - on	oF	
64		**1r**	Loads rotation with functioning hours regul.1	oF - on	on	
65		**2r**	Loads rotation with functioning hours regul.2	oF - on	on	
66		**Hh**	Maximum continuous functioning of a motor	0 ... 9999 hrs	0	
DELAY TIME OF THE LOADS ACTIVATION / DEACTIVATION						
67		**t1**	Minimum time between two successive switch on, of the same motor	0 ... 999 min.	1	
68		**t2**	Minimum time between switch off and switch on, of the same motor	0 ... 999 min.	1	
69		**t3**	Minimum functioning time of the output	0 ... 999 sec.	10	
70		**t4**	Delay time between successive switch on	1 ... 999 sec.	10	
71		**t5**	Delay time between successive switch off	1 ... 999 sec.	10	
OUTPUTS DELAY AT SWITCH ON						
72		**od**	Outputs delay at switch on	0 ... 999 min.	0	
LOW AND HIGH ALARMS						
73		**o1**	Relative high alarm regul. 1	0.00 ... 99.99	5.00	
74		**u1**	Relative low alarm reg. 1	0.00 ... 99.99	5.00	
75		**o2**	Relative high alarm reg. 2	0.00 ... 99.99	5.00	
76		**u2**	Relative high alarm reg. 2	0.00 ... 99.99	5.00	
77		**rA**	High and low alarms delay	0 ... 999 sec.	0	
78		**1d**	High and low alarms differential reg. 1	0.00 ... 99.99	0.50	
79		**2d**	High and low alarms differential reg. 2	0.00 ... 99.99	0.50	
80		**PA**	High and low alarms delay time from switch on	0.00 ... 36.00 hrs. / min.	2.00	
OUTPUTS ALARM						
81		**oL**	Logic of activation for the inputs driving the outputs alarm	on - oF	on	
EXTERNAL ALARM						
82		**LI**	Logic of activation for the external alarm input	on - oF	on	
83		**ti**	Input delay for the external alarm	0 ... 999 sec.	0	
FUNCTIONING HOURS ALARM OF THE MOTORS						
84		**Ah**	Functioning hours alarm of the motors	0 ... 9999 x10 hrs.	0	
ALARM MEMORY						
85		**tA**	Alarm memory	on - oF	oF	
RS485 SERIAL COMMUNICATION						
86		**dn**	Address of the station	1 ... 255	1	
87		**br**	(Baud rate	0 - 1 - 2 - 3	3	
88		**SE**	Programming access through the serial port	Lr / L- / -r	Lr	
P1/P2 AUTOMATIC EXECUTION BY CLOCK						
91		**e1**	Ending hour of P2 autom. execution Sunday	oF- 0.00 ... 23.59 hrs	oF	
92		**b1**	Beginning hour of P2 autom. exec. Sunday	oF- 0.00 ... 23.59 hrs	oF	
93		**e2**	Ending hour of P2 autom. execution Monday	oF- 0.00 ... 23.59 hrs	oF	
94		**b2**	Beginning hour of P2 autom. exec. Monday	oF- 0.00 ... 23.59 hrs	oF	
95		**e3**	Ending hour of P2 autom. execution Tuesday	oF- 0.00 ... 23.59 hrs	oF	
96		**b3**	Beginning hour of P2 autom. exec. Tuesday	oF- 0.00 ... 23.59 hrs	oF	
97		**e4**	Ending hour of P2 autom. execution Wednesday	oF- 0.00 ... 23.59 hrs	oF	
98		**b4**	Beginning hour of P2 autom. exec. Wednesday	oF- 0.00 ... 23.59 hrs	oF	
99		**e5**	Ending hour of P2 autom. execution Thursday	oF- 0.00 ... 23.59 hrs	oF	
100		**b5**	Beginning hour of P2 autom. exec. Thursday	oF- 0.00 ... 23.59 hrs	oF	
101		**e6**	Ending hour of P2 autom. execution Friday	oF- 0.00 ... 23.59 hrs	oF	
102		**b6**	Beginning hour of P2 autom. exec. Friday	oF- 0.00 ... 23.59 hrs	oF	
103		**e7**	Ending hour of P2 autom. execution Saturday	oF- 0.00 ... 23.59 hrs	oF	
104		**b7**	Beginning hour of P2 autom. exec. Saturday	oF- 0.00 ... 23.59 hrs	oF	
REGULATORS SET POINT						
105	**P1**	**SP**	Set Point Regulator 1	L1...H1	0.00	
106	**P2**	**SP**	Set Point Regulator 1	L1...H1	0.00	
107	**P1**	**SF**	Set Point Regulator 2	L2...H2	0.00	
108	**P2**	**SF**	Set Point Regulator 2	L2...H2	0.00	
PASSWORD						
109		**PP**	PASSWORD request	0 ... 999		

5.2 - PARAMETERS DESCRIPTION

MEASURE AND VISUALISATION

C1 - PROBE INA1 CALIBRATION : Positive or negative offset (in degree if the input is for temperture probes or in the proper unit if the input is for normalised signals) which is added to the value measured by the probe INA1, before the visualisation to which is connected the functioning of regulator 1.

C2 - PROBE INA2 CALIBRATION : Positive or negative offset which is added to the value measured by the probe INA2 before the visualisation to which is connected the functioning of regulator 2.

2P - PROBE 2 PRESENCE : It permits to exclude the probe 2, if it's not used (on = probe present, oF = probe not present).

nU - UNIT OF NORMAL VISUALISATION AND PROGRAMMING :

ru - UNIT OF TEMPERATURE MEASUREMENT : It determines, for temperature measures, the visualisation in Centigrade or Fahrenheit degree. It has to be underlined that the change of this parameter modifies the display visualisation but not all the parameters programmed with temperature measure unit , which have to be then manually modified. For example, if the Set was -10°C and the unit is changed, the Set will be -10°F.

dP - DISPLAY RESOLUTION : It allows to have a high measure and programming resolution if programmed as H (0,1° for temperature and 0,01 for pressure) or low if programmed as L (1° for temperture and 0,1 for pressure).

1S - BEGINNING SCALE FOR INPUT INA1 WITH ANALOGUE SIGNALS : It permits to define the begenning scale for input INA1 with normalised signals. It will be then programmed on this parameter : "0" if it's desired to use the beginning scale equal to 0 (0 mA or 0 V) or "n0" if it's desired to have a beginning scale different from 0 (4 mA, 1V or 2V). **1L** - LOWER LIMIT FOR INPUT INA1 WITH ANALOGUE SIGNALS : It's the value that the instrument has

to visualise when at input INA1 is present the minimum measurable value of the scale (0/4 mA, 0/1 V or 0/2 V).

1H - HIGHER LIMIT FOR INPUT INA1 WITH ANALOGUE SIGNALS : It's the value that the instrument has to visualise when at input INA1 is present the maximum measurable value of the scale (20 mA, 5 V or 10 V).

2S - BEGINNING SCALE FOR INPUT INA2 WITH ANALOGUE SIGNALS : It permits to define the begenning scale for input INA2 with normalised signals. It will be then programmed on this parameter : "0" if it's desired to use the beginning scale equal to 0 (o mA or 0 V) or "n0" if it's desired to have a beginning scale different from 0 (4 mA, 1V or 2V).

2L - LOWER LIMIT FOR INPUT INA2 WITH ANALOGUE SIGNALS : It's the value that the instrument has to visualise when at input INA2 is present the minimum measurable value of the scale (0/4 mA, 0/1 V or 0/2 V).

2H - HIGHER LIMIT FOR INPUT INA2 WITH ANALOGUE SIGNALS : It's the value that the instrument has to visualise when at input INA2 is present the maximum measurable value of the scale (20 mA, 5 V or 10 V).

rt - REFRIGERATING GAS USED : If it's desired to have the conversion pressure (bar) / temperature (°) or vice versa it's necessary to program on this parameter the refrigerating gas used in the plant, as follows : 0 = none (the instrument doesn't effect the conversion); 1 = R134A ; 2 = R22 ; 3 = R502 ; 4 = R404A ; 5 = R 717 (AMMONIA) ; 6 = R507 ; 7 = R407A ; 8 = R407B ; 9 = R407C ; 10 = R410A ; 11 = R32 ; 12 = R125

OUTPUTS CONFIGURATION

nC - MOTORS NUMBER (COMPRESSORS) REGULATOR 1: program on this parameter the number of motors controlled by regulator 1 (max. 8). **S1** - STEPS NUMBER OF COMPRESSOR 1 REGULATOR 1 : program on this parameter the number of steps (stages) of motor number 1

S2 - STEPS NUMBER OF COMPRESSOR 2 REGULATOR 1 : program on this parameter the number of steps (stages) of motor number 2

S3 - STEPS NUMBER OF COMPRESSOR 3 REGULATOR 1 : program on this parameter the number of steps (stages) of motor number 3

S4 - STEPS NUMBER OF COMPRESSOR 4 REGULATOR 1 : program on this parameter the number of steps (stages) of motor number 4

S5 - STEPS NUMBER OF COMPRESSOR 5 REGULATOR 1 : program on this parameter the number of steps (stages) of motor number 5

S6 - STEPS NUMBER OF COMPRESSOR 6 REGULATOR 1 : program on this parameter the number of steps (stages) of motor number 6

S7 - STEPS NUMBER OF COMPRESSOR 7 REGULATOR 1 : program on this parameter the number of steps (stages) of motor number 7

S8 - STEPS NUMBER OF COMPRESSOR 8 REGULATOR 1 : program on this parameter the number of steps (stages) of motor number 8

nF - MOTORS NUMBER (FANS) REGULATOR 2: program on this parameter the number of motors controlled by regulator 2 (if it's alsoused input INA2 and then regulator 2)

P1 - OUTPUT OUT 1 POWER (REGULATOR 1) : program a number (common to all the outputs) which indicates the power controlled by output OUT1 (Power in KW or in CV or the flow or something else)

P2 - OUTPUT OUT 2 POWER (REGULATOR 1): Similar to "P1" but referred to OUT2

P3 -OUTPUT OUT 3 POWER (REGULATOR 1): Similar to "P1" but referred to OUT3

P4 - OUTPUT OUT 4 POWER (REGULATOR 1): Similar to "P1" but referred to OUT4

P5 - OUTPUT OUT 5 POWER (REGULATOR 1): Similar to "P1" but referred to OUT5

P6 - OUTPUT OUT 6 POWER (REGULATOR 1): Similar to "P1" but referred to OUT6

P7 - OUTPUT OUT 7 POWER (REGULATOR 1): Similar to "P1" but referred to OUT7

P8 - OUTPUT OUT 8 POWER (REGULATOR 1): Similar to "P1" but referred to OUT8

PARAMETERS OF REGULATOR 1

1C - REGULATION TYPE OF REGULATOR 1 : It permits to select the regulation type between ON/OFF (on), Neutral Zone (nr) or Proportional (Pr) of regulator 1

1A - ACTION TYPE OF REGULATOR 1 : It decides if regulator 1 has to work with direct action with the probe placed on the suction side (C1) i.e. it has to drive compressors, with direct action with the probe placed on the condensing side (C2) i.e. it has to control condensing ventilators, with reverse action with the probe placed on the suction side (H1) or with reverse action and with the probe placed on the condensing side (H2).

d1 - CONTROL BAND OF REGULATOR 1 : In case of ON/OFF control, it is the value, respect to Set “SP”, between request of outputs switch on and request of outputs switch off; in case of Neutral Zone control it represents the width of Neutral Zone around “SP” set and in case of Proportional control it’s the width of the control band around the Set “SP”.

r1 - MANUAL RESET REGULATOR 1 : It’s the positive or negative Offset which allows to move the control band, respect to Set "SP". If programmed = 0, Set "SP" is considered at the center of the control band.

L1 - MINIMUM SET REGULATOR 1 : It’s the lowest value programmable as Set for regulator 1 (SP).

H1 - MAXIMUM SET REGULATOR 1 : It’s the highest value programmable as Set for regulator 1 (SP).

E1 - OUTPUTS STATE FOR REGULATOR 1 IN ERROR CONDITIONS, WITH PROBE INA1 : It permits to decide, in case of probe INA1 in error conditions, if the outputs controlled by regulator 1 have to be deactivated (0), have to maintain the state they had at the moment of the occurring error (1) or have to be activated in order to supply to the plant the power programmed on par. “F1” (2).

F1 - POWER TO BE SUPPLIED AS OUTPUT OF REGULATOR 1 IN CASE OF INA1 PROBE ERROR : If par. "E1" =2 , do program the power to be supplied to the plant in case of INA1 probe error.

PARAMETERS OF REGULATOR 2

2C - REGULATION TYPE OF REGULATOR 2 : It permits to select the regulation type between ON/OFF (on), Neutral Zone (nr) or Proportional (Pr) of regulator 2

2A - ACTION TYPE OF REGULATOR 2 : It decides if regulator 2 has to work with direct action (C) or reverse action (H).

d2 - CONTROL BAND OF REGULATOR 2 : In case of ON/OFF control, it is the value, respect to Set “SF”, between request of outputs switch on and request of outputs switch off; in case of Neutral Zone control it represents the width of Neutral Zone around “SF” set and in case of Proportional control it’s the width of the control band around the Set “SF”.

r2 - MANUAL RESET REGULATOR 2 : It’s the positive or negative Offset which allows to move the control band, respect to Set "SF". If programmed = 0, Set "SF" is considered at the center of the control band.

L2 - MINIMUM SET REGULATOR 2 : It’s the lowest value programmable as Set for regulator 2 (SF).

H2 - MAXIMUM SET REGULATOR 2 : It’s the highest value programmable as Set for regulator 2 (SF).

E2 - OUTPUTS STATE FOR REGULATOR 2 IN ERROR CONDITIONS, WITH PROBE INA2 : It permits to decide, in case of probe INA2 in error conditions, if the outputs controlled by regulator 2 have to be deactivated (0), have to maintain the state they had at the moment of the occurring error (1) or have to be activated in order to supply to the plant the power programmed on par. “F2” (2).

F2 - POWER TO BE SUPPLIED AS OUTPUT OF REGULATOR 2 IN CASE OF INA2 PROBE ERROR : If par. "E2" =2 , do program the power to be supplied to the plant in case of INA2 probe error.

SWITCH ON/OFF PRIORITY

ES - SAVING OF MOTORS FUNCTIONING FOR REGULATOR 1 : It permits to decide, if with regulator 1 are controlled multistages compressors, the switch off priority of the motors (on) or of the multistages valves (oF), obviously with equal power.

PS - SWITCH ON/OFF PRIORITY IN CASE OF PROGRESSIVE POWER ACTUATION FOR REGULATOR 1 : It permits to decide, if with regulator 1 are not controlled multistages compressors and the

outputs are driving different powers, if actuate progressively all the possible combinations, in order to obtain the minimum possible power increase / decrease (on) or if activate / deactivate the outputs starting from the minor power but without trying all the combinations (oF).

1r - LOADS ROTATION WITH FUNCTIONING HOURS - REGULATOR 1 : If programmed = on, regulator 1 will provide, in case of equal power, to activate the outputs with the lowest number of functioning hours, otherwise, if programmed = oF, it will provide, still with equal powers, to activate the first output in numerical order or to deactivate the last one in numerical order, not considering the functioning hours.

2r - LOADS ROTATION WITH FUNCTIONING HOURS - REGULATOR 2 : Similar to par. "1r" but referred to regulator 2.

Hh - MAXIMUM CONTINUOUS FUNCTIONING OF A MOTOR : On this parameter it's possible program the maximum continuous functioning hours of a motor, at the end of whcih the controller, after have verified that it's available another motor (or a plant in case of multistage compressor) provides to switch off the output (or plant) and to activate the output (or plant) available. The function is not active if par. is = 0.

DELAY TIME OF THE LOADS ACTIVATION / DEACTIVATION

t1 - MINIMUM TIME BETWEEN TWO SUCCESSIVE SWITCH ON, OF THE SAME MOTOR : This parameter regards only the outputs driving motors controlled by regulator 1, it's used to avoid compressors "short cycles" and it's programmable in minutes.

t2 - MINIMUM TIME BETWEEN SWITCH OFF AND SWITCH ON OF THE SAME MOTOR : Similarly to par. "t1", it regards only outputs driving motors controlled by regulator 1, it's used to avoid compressors "short cycles" and it's programmable in minutes

t3 - MINIMUM FUNCTIONING TIME OF THE OUTPUT : It's the minimum functioning time of an output since it has been activated, it regards all the outputs and it's programmable in sec.

t4 - DELAY TIME BETWEEN SUCCESSIVE SWITCH ON : It's the delay , since the output is activated, which regards all the outputs and it's expressed in sec.

t5 - DELAY TIME BETWEEN SUCCESSIVE SWITCH OFF : It's the delay, since the output is deactivated, until the deactivation of the successive output, expressed in sec.

OUTPUTS DELAY AT SWITCH ON

od - OUTPUTS DELAY AT SWITCH ON : It's the delay time of the outputs activation at the instrument switch on. During this time the instrument shows the message "od".

LOW AND HIGH ALARMS

o1 - RELATIVE HIGH ALARM - REGULATOR 1 : It's the value relative to Set "SP", at the higher of which intervenes the high alarm signal of regulator 1 (the alarm is activated when the measure of probe INA1 goes higher than the value "SP" + "o1").

u1 - RELATIVE LOW ALARM - REGULATOR 1 : It's the value relative to Set "SP", at the under of which intervenes the low alarm signal of regulator 1 (the alarm is activated when the measure of probe INA1 goes under than the value "SP" - "u1").

o2 - RELATIVE HIGH ALARM - REGULATOR 2 : It's the value relative to Set "SF", at the higher of which intervenes the high alarm signal of regulator 2 (the alarm is activated when the measure of probe INA2 goes higher than the value "SF" + "o2").

u2 - RELATIVE LOW ALARM - REGULATOR 2 : It's the value relative to Set "SF", at the under of which intervenes the low alarm signal of regulator 2 (the alarm is activated when the measure of probe INA2 goes under than the value "SF" - "u2").

rA - HIGH AND LOW ALARMS DELAY : It's the activation delay time of the high and low alarms, expressed in sec.

1d - HIGH AND LOW ALARMS DIFFERENTIAL : It's the differential between the activation and deactivation respect to the set of high and low alarms of regulator 1 (par. "o1", "u1").

2d - HIGH AND LOW ALARMS DIFFERENTIAL : It's the differential between the activation and deactivation respect to the set of high and low alarms of regulator 2 (par. "o2", "u2").

PA - HIGH AND LOW ALARMS DELAY TIME FROM SWITCH ON : It's the delay time of the high and low alarms starting from the instrument switch on. This delay is active only if, at the switch on, the instrument is into alarm conditions of the process value and it's then erased when the instrument is not into alarm conditions of the process value.

OUTPUTS ALARM

oL - LOGIC OF ACTIVATION FOR THE INPUT DRIVING THE OUTPUTS ALARM : It permits to decide if the digital inputs of the outputs alarms cause the function activation at their closing (on) or at their opening (oF).

EXTERNAL ALARM

LI - LOGIC OF ACTIVATION FOR THE EXTERNAL ALARM INPUT : It permits to decide if the digital input causes the function activation at its closing (on) or at its opening (oF).

ti - INPUT DELAY FOR THE EXTERNAL ALARM : It's the activation delay of the digital input function, expressed in sec.

FUNCTIONING HOURS ALARM OF THE MOTORS

Ah - FUNCTIONING HOURS ALARM OF THE MOTORS : If any of the motor reaches the number of functioning hours programmed on this parameter, it will occur the alarm.This function is not active if the par.= 0.

ALARMS MEMORY

tA - ALARMS MEMORY : It permits to decide if the instrument does not have to store the alarms and therefore the alarm signalling has to be erased (oF), or it has to store the occurred alarms and, at the end of the alarm conditions, it should keep led "ALARM" flashing, in order to indicate that the alarm occurred. (on).

RS485 SERIAL COMMUNICATION

dn - ADDRESS OF THE STATION : It's used for define the instrument address into the communication net. Do program then a different number for each station, from 1 to 255.

br - TRASMISSION SPEED (BAUD RATE) : Do program the datas transmission speed (Baud-rate) of the net into whcih is connected the instrument. This par. is programmable as 0 (1200 baud), 1 (2400 baud) 2 (4800 baud), 3 (9600 baud). All the stations must have the same transmission speed.

SE - PROGRAMMING ACCESS THROUGH THE SERIAL PORT: Programming access. If programmed as "L-" this means that the instrument is programmable only from the keyboard, if programmed as "Lr" it's programmable both from the keyboard and serial line and if programmed as "r-" this means that the instrument is programmable only from serial line. In this last case or if is having place a communication through the RS485 serial port, if it's tried to get into the programming on the display will appear "rO" to indicate that the access is denied

P1/P2 AUTOMATIC EXECUTION BY CLOCK

e1 - ENDING HOUR OF P2 AUTOM. EXEC. SUNDAY
b1 - BEGINNING HOUR OF P2 AUTOM. EXEC. SUNDAY
e2 - ENDING HOUR OF P2 AUTOM. EXEC. MONDAY
b2 - BEGINNING HOUR OF P2 AUTOM. EXEC. MONDAY
e3 - ENDING HOUR OF P2 AUTOM. EXEC. TUESDAY
b3 - BEGINNING HOUR OF P2 AUTOM. EXEC. TUESDAY
e4 - ENDING HOUR OF P2 AUTOM. EXEC. WEDNESDAY
b4 - BEGINNING HOUR OF P2 AUTOM. EXEC. WEDNESDAY
e5 - ENDING HOUR OF P2 AUTOM. EXEC. THURSDAY
b5 - BEGINNING HOUR OF P2 AUTOM. EXEC. THURSDAY
e6 - ENDING HOUR OF P2 AUTOM. EXEC. FRIDAY
b6 - BEGINNING HOUR OF P2 AUTOM. EXEC. FRIDAY
e7 - ENDING HOUR OF P2 AUTOM. EXEC. SATURDAY
b7 - BEGINNING HOUR OF P2 AUTOM. EXEC. SATURDAY

REGULATORS SET POINT

SP - REGULATOR 1 SET POINT : It's the Set point value of regulator 1

SF - REGULATOR 2 SET POINT :It's the Set point value of regulator 2

PASSWORD

PP - PASSWORD REQUEST: It's the password request to accede to the protected parameters programming or to restore the original configuration.

6 - PROBLEMS, MAINTENANCE AND WARRANTY

6.1 - ERRORS SIGNALLING

The panel displays are used to visualise also error conditions of the instrument showing the following messages :

Error	Cause	Action
"E1" "-E1" Probe Error INA 1	The probe may be interrupted or in short-circuit or may read a value outside of the allowed range	Verify the correct connection between probe and instrument and finally verify the correct functioning of the probe itself
"E2" "-E2" Probe Error INA 2		
"EE"	Internal memory error	Verify and, if necessary, reprogram the parameters.
"noCL"	The instrument is not equipped with the Clock and it's tried to get into the clock programming.	No action. If you want the clock is neces-sary to order a new instrument
"oFFL"	There is no communication between TDC and TDP units.	Verify the correct connection between units and finally verify the correct functioning of units.
"busy"	It's happening the programming through the serial door (RS 485) and it's tried to get into the programming from TDP panel interface.	Waiting the end of remote programming session.

6.2 - CLEANING

It's raccomanded to clean TDP only with a cloth welted with water or with a detergent neither abrasive nor containing solvents and to clean TDC only with a dry cloth.

6.3 - WARRANTY AND REPAIRS

The instrument is under warranty against construction vices or defected material, noticed within 12 months from delivery date.
The warranty is limited to the repairs or to the substitution of the instrument.
The eventual opening of the housing, the violation of the instrument or the wrong use and installation of the product means the automatically decay of the warranty.
In case of defected instrument, noticed in warranty period or out of warranty, do contact our sales department to obtain the shipment authorisation.
The defected product must be shipped to TECNOLOGIC with the detailed description of the failures found and without any fees or charge for TECNOLOGIC, safe different agreements.

7 - TECHNICAL DATA

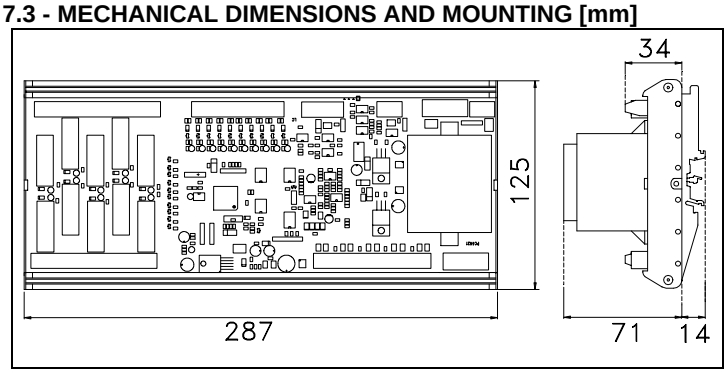
7.1 - ELECTRICAL DATA

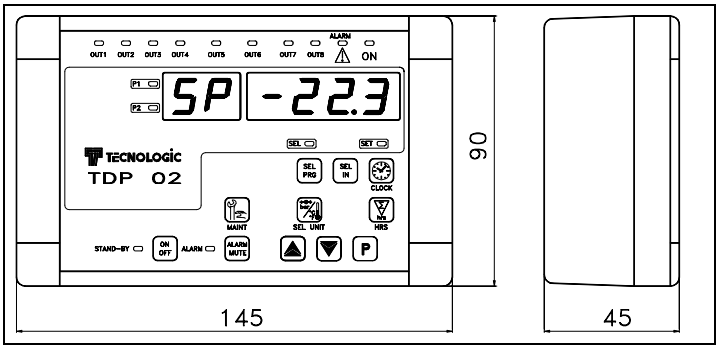
Power supply TDC: 24, 110, 230 VAC +/- 10%
Power supply TDP: 24 VAC/VDC +/- 10%
Frequency AC: 50/60 Hz
Power consumption: Max. 20 VA approx.
Input/s: up to 2 inputs for normalised signals (0/4...20mA, 0/1...5V, 0/2...10V) or for PTC temperature probes (KTY 81-121 990 Ω at 25° C) or NTC temperature probes (103AT-2 10 KΩ at 25 °C) and 10 digital inputs free-voltage contacts
Input Impedance for normalized signals: 0/4...20 mA = 500 Ω; 0/1...5 V , 0/2...10 V = 2 MΩ
Output/s : up to 10 relay outputs (8A-AC1, 3A-AC3 250 VAC)
Electrical life for relay outputs: 100000 operations
Installation Category (Overvoltage Cat.) : II
Protection class against electric shock TDP: Class III
Insulation TDC: Reinforced insulation between the low voltage section (supply and relay outputs) and the extra low voltage section (inputs and communication ports); No insulation between inputs and digital inputs.

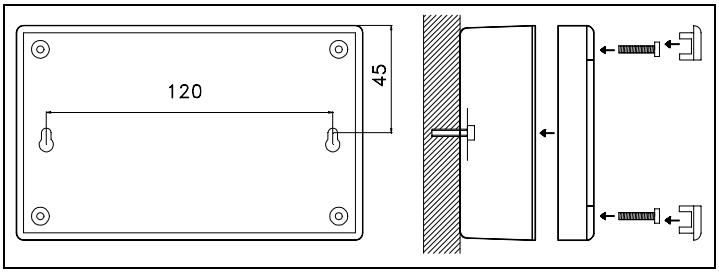
7.2 - MECHANICAL DATA

Housing TDC: Self-extinguishing plastic UL 94 V1 (Din/rail housing) - V0 (fixing devices)
Housing TDP: Self-extinguishing plastic
Dimensions TDC : 287 x 125 mm, high 84 mm
Dimensions TDP: 145 x 90 mm, dept 45 mm
Weight TDC : 1150 g approx.
Weight TDP : 210 g approx.
Mounting TDC: backboard on OMEGA DIN RAIL
Mounting TDP: Wall mounting or flush in panel
Connections: 2,5 mm^2 screw terminal block
Protection degree of front panel TDP: IP 54 with gasket
Pollution Degree : 2
Operating temperature: 0 ... 55 °C
Operating humidity: 30 ... 95 RH% without condensation
Transport and storage temperature: -10 ... +60 °C

7.3 - MECHANICAL DIMENSIONS AND MOUNTING [mm]







7.4 - FUNCTIONAL DATA

Temperature control: ON/OFF, NEUTRAL ZONE or PROPORTIONAL
Measurement Range : normalised signals : -99.9...999.9; PTC: -50...150 °C / -58 ... 199 °F; NTC: -50 ... 50 °C / -58...122 °F
Display resolution: 0,01 or 0,1 for normalised signals, 1° or 0,1° for temperature
Overall Accuracy: +/- 0,5 % fs
Sampling rate: 2 samples per second
Type of serial interface: RS485 optoisolated
Communication protocol: MODBUS RTU (JBUS)
Baud rate: programmable from 1200 ... 9600 baud
Endurance time of the internal clock without power supply: 7 years approx. by internal battery
Display: Red h 13 mm, 4 Digit (measure/value) + 2 Digit (Param. label)
Compliance: ECC directive EMC 89/336 (EN 50081-1, EN 50082-1), ECC directive LV73/23 and 93/68 (EN 61010-1)

7.5 - INSTRUMENT CODE

TDC 02 a b c d e ff
a = POWER SUPPLY
A: 24 VAC
C: 110 VAC
D: 230 VAC
b = INA1 INPUT
C: For normalised signals 0/4 ... 20 mA (Pressure probes TPR)
P: For PTC probes (KTY81-121)
N: For NTC probes (103AT-2)
W: For normalised signals 0/2 ... 10 V
c = INA2 INPUT
C: For normalised signals 0/4 ... 20 mA (Pressure probes TPR)
P: For PTC probes (KTY81-121)
N: For NTC probes (103AT-2)
W: For normalised signals 0/2 ... 10 V
- : Not Present
d = INTERNAL CLOCK
C : Present
- : Not Present
e = RS 485 SERIAL INTERFACE
S : Present
- : Not Present
ff = SPECIAL CODES