FORTEST

catch the leak.

Protocol PROFINET for T-Series and M-Series ForTest

PROFINET®

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Summary

Introduction

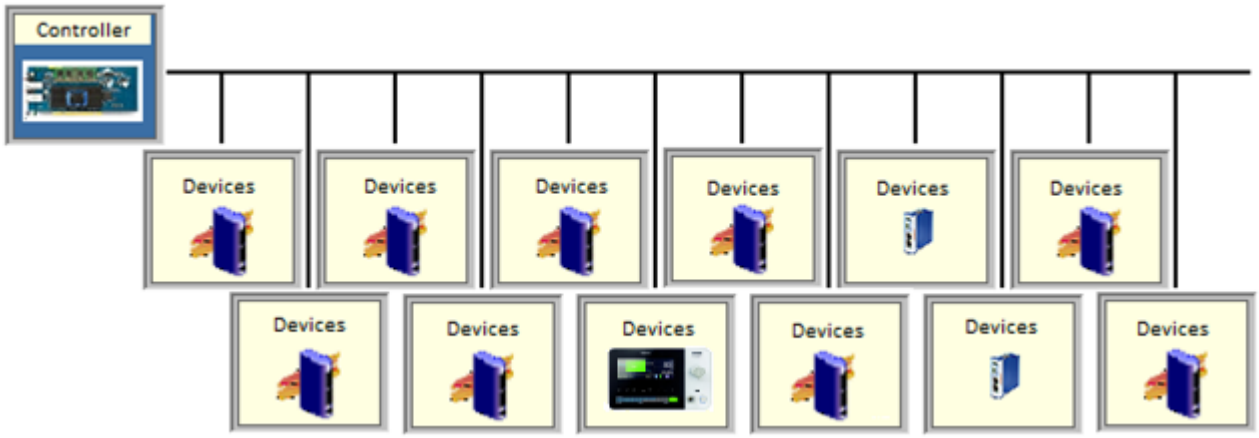
The purpose of this document is to provide all the technical specifications for communicate with leak testing devices of ForTest T-Series using the PROFINET protocol.

PROFINET (profinet acronym for Process Field Net) is an industry technical standard for data communication over Industrial Ethernet, designed for collecting data from, and controlling, equipment in industrial systems, with a particular strength in delivering data under tight time constraints (on the order of 2ms or less).

The standard is maintained and supported by Profibus & Profinet International

A PROFINET IO system consists of the following devices:

- The IO Controller, which controls the automation task.
- The IO Device, which is a field device, monitored and controlled by an IO Controller.



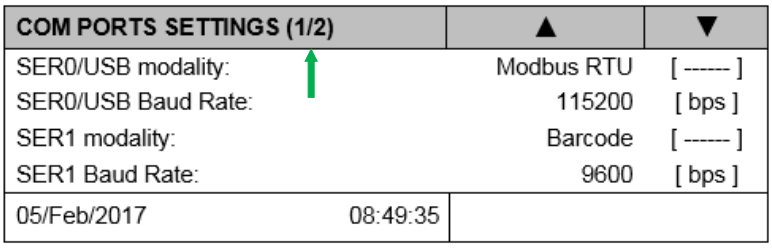
Three protocol levels are defined:

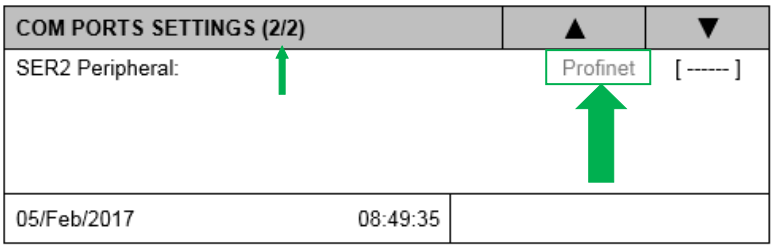
- TCP/IPfor non time-critical data and the commissioning of a industrial plant with reaction times in the range of 100 ms
- RT (Real-Time) protocol for PROFINET IO applications up to 10 ms cycle times
- IRT (Isochronous Real-Time) for PROFINET IO applications in drive systems[2] with cycles times of less than 1 ms

Configuration

To enable the expansion board with Profinet interface it's necessary to set the following parameters into the SET menu of a ForTest equipment.

To move to the second menu, select a parameter and press the DOWN ARROW button.





The purpose of these settings is to enable the communication between the data broker of the Fieldbus and the microcontroller ForTest. If these parameters are not set correctly the fields transmitted will be empty.

The data exchange between Fieldbus and Profinet will be explained in the next pages.

Communication parameters

The communication parameters are used for identification of themodule in your application. The unique assignment of thesecommunication parameters is the precondition for communicability of
the module within your application.

The following adjustments can be made for PROFINET:

- Station Name
- IP Address
- Subnet Mask
- Gateway Address

Profinet uses IPv4 to assign address to every station.

IP addressing is configurated on the firmware of gateway directly from ForTest

Defaults values are:

IP ADDRESS:	192.168.20.3
SUBNET MASK:	255.255.255.0
GATEWAY:	192.168.20.1
STATION NAME:	fortest-tps1

Change IP settings

There are three ways to change the network card settings:

1. Via a PC using configuration software

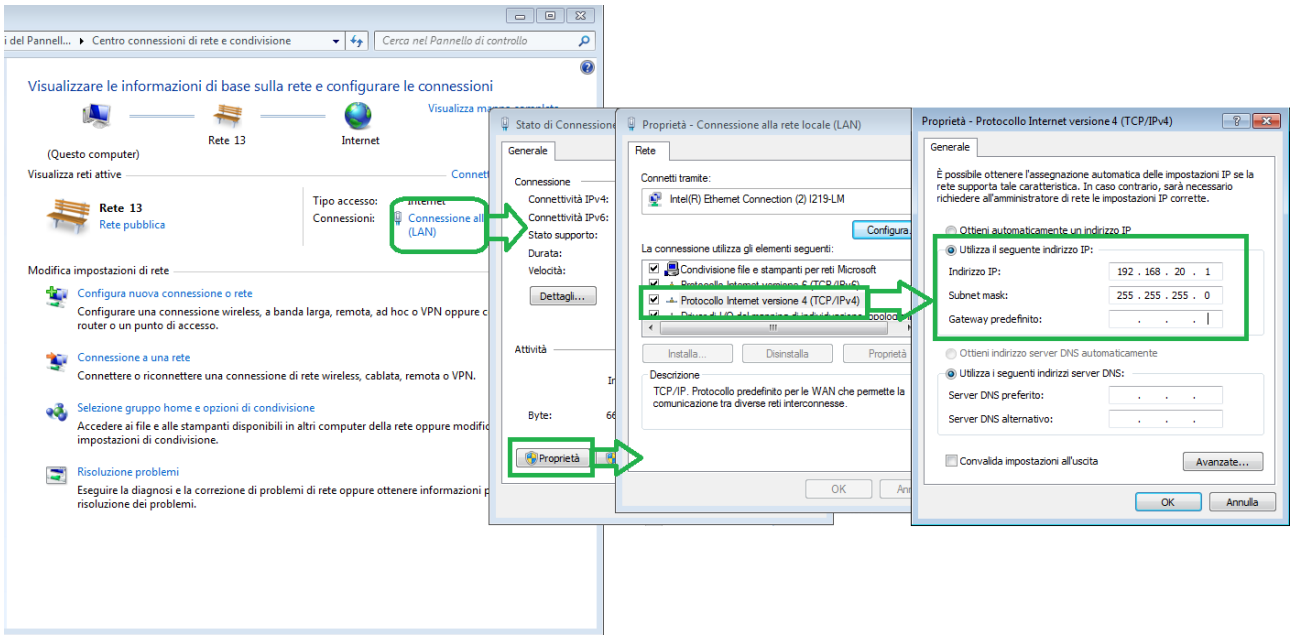
2. Via a PC by uploading a configuration file via FTP

3. Via external IO Controller of the PLC

The first two methods, which require a direct connection via RJ45 cable to a Windows based PC, are examined. Method three depends on the type of Profinet I/O controller available and depends from the vendor.

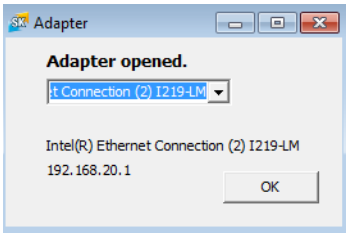
Method 1.

1. Configure the LAN card address of the PC with an address in the same network of the IP that will be assigned to the device (for example, if the device will be IP 192.168.20.3, the PC will be 192.168.20.1) then connect it directly to equipment.

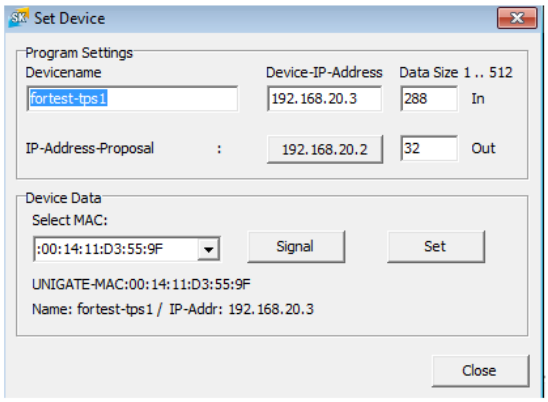


2. Direct connect the LAN card to the RJ45 port using a Ethernet cable.

3. Download software "StarterKit" software from this link and install it.
4. Execute the application "ProfinetModul.exe" from the installation folder.
5. Open the software > "Option" > "Select Network" > "OK" to confirm you're using the correct LAN card connected to the equipment



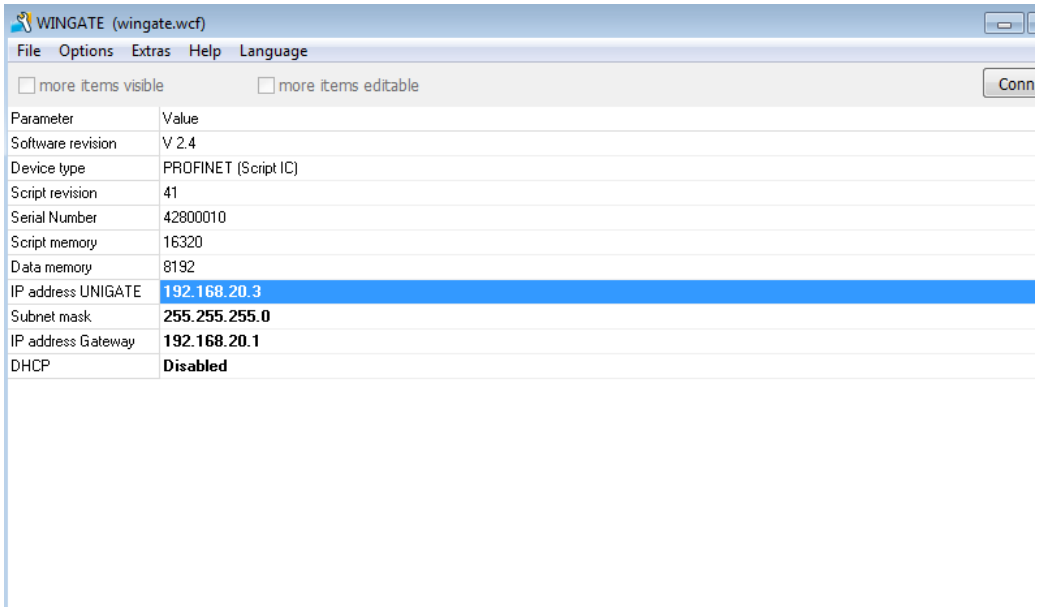
6. "Option" > "Scan/Set Device" > Wait the end of the scan. Default configuration would be found. IP address and device name can be changed manually. Data size IN must be set to 288 bytes and OUT to 32 bytes. Press "Set" button to write changes to ethernet card.



7. "Option" > "Start" > Data exchange will start

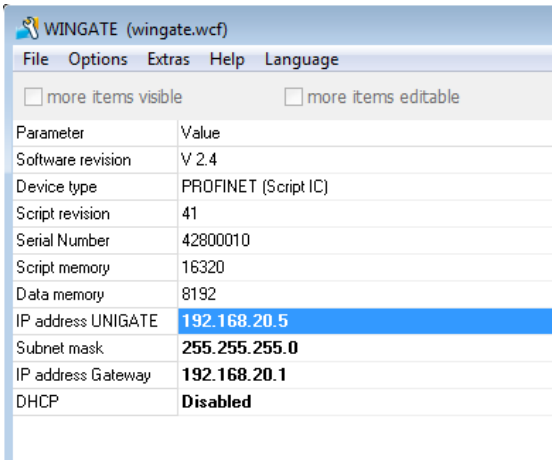
Method 2.

1. It is needed a Windows based PC and some configuration tools. Please download and install WINGATE from this link
2. Download the standard file configuration from this link
3. Open WINGATE and load the configuration file "*system.gwc*" from "File" > "Open"
4. Following default settings will be loaded

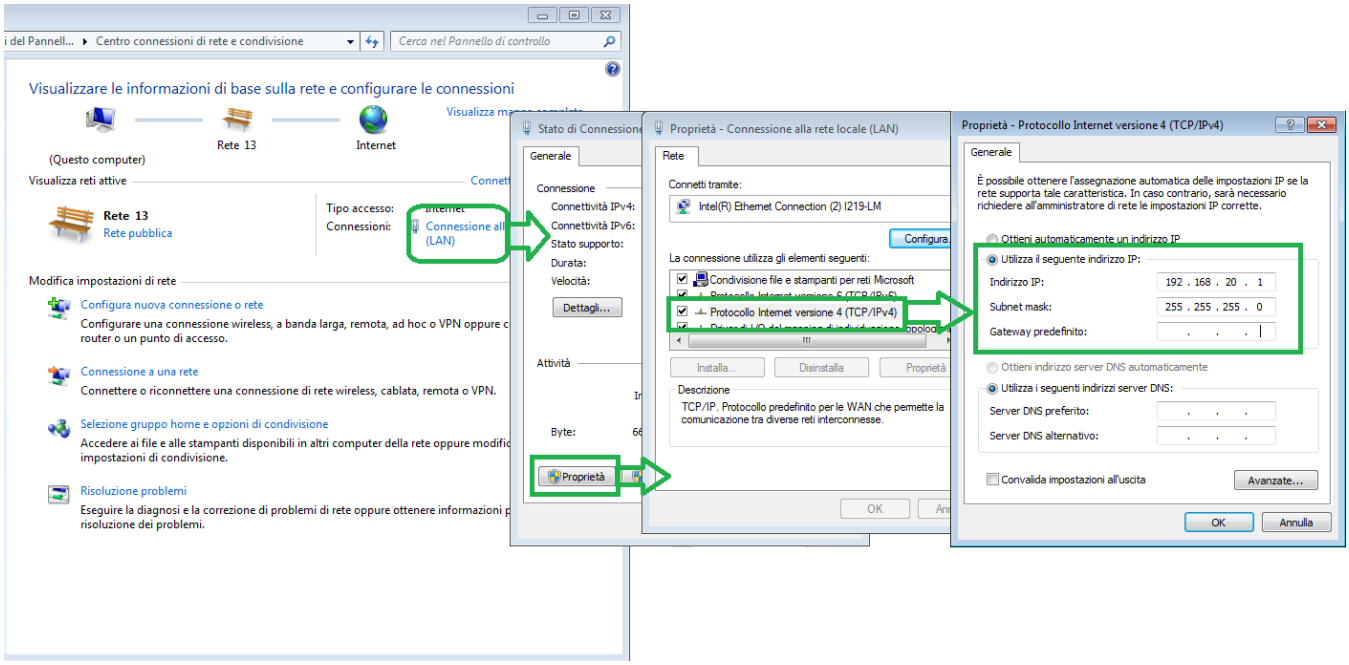


5. Change the IP settings of the device in the field "IP address UNIGATE" with the desired address to assign. Subnetmask and gateway must be in according with it.

   For example we change the default IP to 192.168.20.5

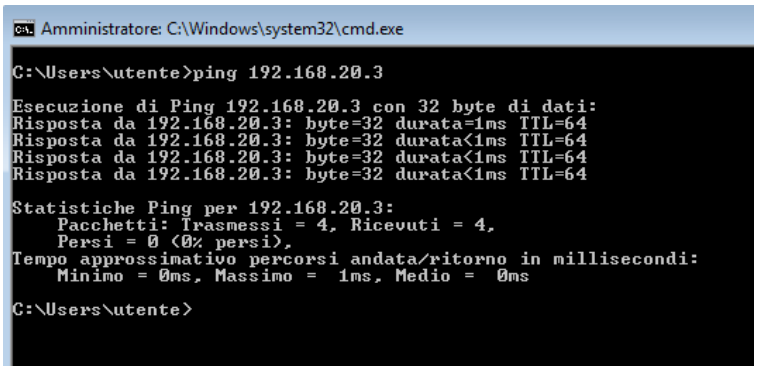


6. Configure the LAN card address of the PC with an address in the same network of the IP that will be assigned to the device (for example, if the device will be IP 192.168.20.3, the PC will be 192.168.20.1)

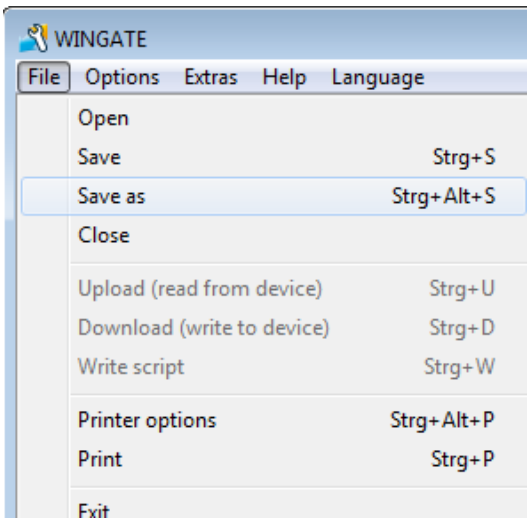


7. Direct connect the LAN card to the RJ45 port using a Ethernet cable.

8. Check that the default IP of the device is reachable for example using the command "ping 192.168.20.3 -t 9999" from command line.

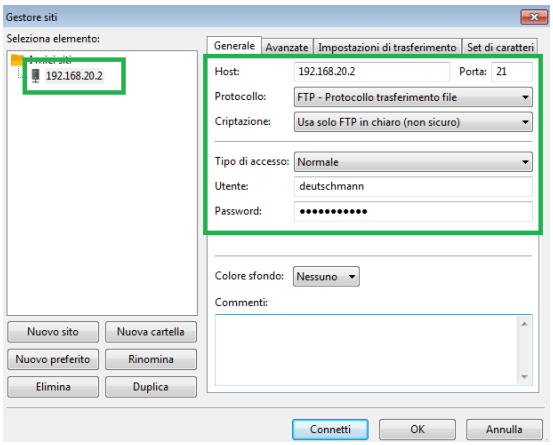


9. In WINGATE save the configuration (GWC file) using the file name "system.gwc"

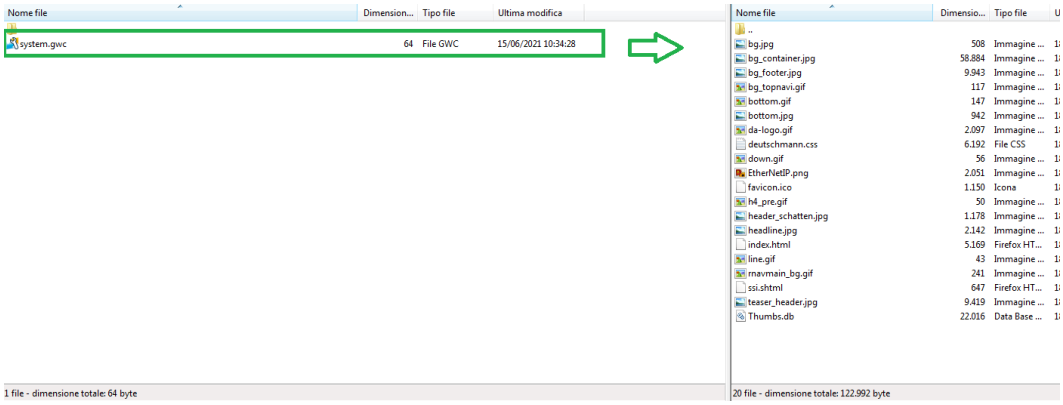


10. Open a ftp connection to the default IP of the device 192.168.20.3 using "deutschmann" as username and password (ftp://192.168.20.3:21)

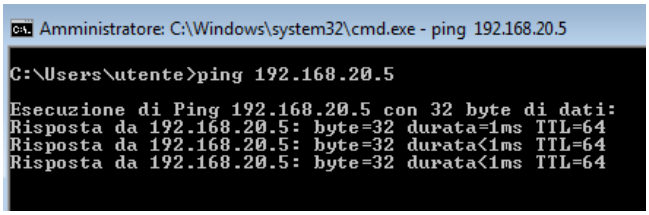
    For example using FileZilla FTP Client it is necessary to execute following settings



11. Transfer the file to the ftp folder. After completion of the write process, please disconnect from the FTP server and restart the equipment by switch off and on the power supply button. Upon device startup the device will takes over the configuration contained in the file and deletes the file afterwards.



12. New configuration will be loaded after the restart of the equipment. Is it possible to check it using the "ping" command as already described in the step n.8



NOTE : Please pay attention to the settings used when loading the parameters.

Synchronisation and I/O Cycle

Technical specification of Profinet Interface

Refresh Time	
Input	<2 ms
Output	<2 ms

Watchdog	
Input	3 ms
Output	3 ms

Synchronisation	
RT Class	RT_CLASS_1

Communication timeout	
Timeout	1000 ms
Idle time	100 ms

Modules and Submodules

Profinet interface has 9 virtual input/output modules. Slot 0 always contain the DAP module (Device Access Point) and cannot be changed. Slot 1-8 can be input modules, output modules or input/output modules. Dummy modules serve as placeholders. Max of 288 inputs and 288 output bytes can be managed.

The default configuration of the device is set with 288 input bytes and 32 output bytes. Input bytes contains data from the device (status and test results). Output bytes contains the data that is sent to the device (program change, start test, stop test)

Technical specification of Profinet Interface

Slot	Order number/designation	Input Length (bytes)	Output Length (bytes)
0	DAP	-	-
1	Input 32 bytes	32	-
2	Output 32 bytes	-	32
3	Input 128 bytes	128	-
4	Input 128 bytes	128	-
5	Dummy	-	-
6	Dummy	-	-
7	Dummy	-	-
8	Dummy	-	-
Total registers availables		288	32

NOTE : All TST and SET parameters are stored into a EEPROM memory so a defined number of written are allowed by this technology. Please limit the number of write and use the "program change" command to switch between differents test parameters.

GSDML File configuration

The GSDML file contain the configuration of the Profinet interface and must be uploaded into the IO Controller to automatically inform the master device how require packets to the slave device.

Actually GSDML version supported and checked is V2.31

GSDML FILE CONFIGURATION

http://downloads.fortest-leak-testing.it/PROFINET/GSDML-UNIGATE-IC2P-20150826-120500.zip

Input table

Values are shifted in 8 bit part LOW and 8 bit part HIGH.

To obtain a 16 bit value is necessary to perform the following operation :

VALUE = (256 x HIGH) + LOW

To obtain a 32 bit value is necessary to perform the following operation VALUE = $B0_L$ + ($B1_H$ x 256) + ($B2_L$ x 256 x 256) + ($B3_H$ x 256 x 256 x 256)

Position	Description	Reference	Example values (dec)	
1	Errors mask and barcode flag LOW	Table-Error	32 (No error)	STATUS IN REAL TIME
2	Errors mask and barcode flag HIGH	Table-Error	0	
3	Current active status on the device LOW	Table-Status	0 (Waiting)	
4	Current active status on the device HIGH	Table-Status	0	
5	Current active result phase on the device LOW	Table-Phase	0 (Not active)	
6	Current active result phase on the device HIGH	Table-Phase	0	
7	Last active result phase on the device LOW	Table-Results	0	
8	Last active result phase on the device HIGH	Table-Results	0	
9	INTERNAL USE	-	-	
10	INTERNAL USE	-	-	
11	Program Number active on the device LOW	-	0 (Prg: 000)	
12	Program Number active on the device HIGH	-	0	
13	Number of tests executed on the device LOW	-	0 (No pending results)	
14	Number of tests executed on the device HIGH	-	0	
15	INTERNAL USE	-	-	
16	INTERNAL USE	-	-	
17	INTERNAL USE	-	-	
18	INTERNAL USE		-	
19	INTERNAL USE	-	-	
20	INTERNAL USE	-	-	
21	INTERNAL USE	-	-	
22	INTERNAL USE	-	-	
23	Time remaining end of current phase (LOW)	-	0 (Seconds left)	
24	Time remaining end of current phase (HIGH)	-	0	
25	Time remaining end of current phase (LOW)	-	0	
26	Time remaining end of current phase (HIGH)	-	0	
27	Unit measure of time LOW	Table Measure	60 (Seconds)	
28	Unit measure of time HIGH	Table Measure	0	
29	Decimal points of time LOW	-	1	
30	Decimal points of time HIGH	-	0	
31	Sign of the pressure LOW	0 : positive 255 : negative	0	
32	Sign of the pressure HIGH	0 : positive 255: negative	0	
33	Pressure evaluated LOW	-	-	
34	Pressure evaluated HIGH	-	-	
35	Pressure evaluated LOW	-	-	
36	Pressure evaluated HIGH	-	-	
37	Unit measure of pressure LOW	Table Measure	0 (mbar)	
38	Unit measure of pressure HIGH	Table Measure	0	
39	Decimal points pressure LOW	-	1 (example: 123.4)	
40	Decimal points pressure HIGH	-	0	

41	Sign of decay LOW	0: positive 255 : negative	0	
42	Sign of decay HIGH	-	0	
43	Decay at end of test LOW	-	-	
44	Decay at end of test HIGH	-	-	
45	Decay at end of test LOW	-	-	
46	Decay at end of test HIGH	-	-	
47	Unit measure of the decay LOW	Table Measure	0 (mbar)	
48	Unit measure of the decay HIGH	Table Measure	0	
49	Decimal points decay at end of test LOW	-	3 (example: 0.205)	
50	Decimal points decay at end of test HIGH	-	0	
51	INTERNAL USE	-	-	
52	INTERNAL USE	-	-	
53	INTERNAL USE	-	-	
54	INTERNAL USE	-	-	
55	INTERNAL USE	-	-	
56	INTERNAL USE	-	-	
57	INTERNAL USE	-		
58	INTERNAL USE	-		
59	Mask 8 OUTPUT LOW	-		
60	Mask 8 OUTPUT HIGH	-		
61	Mask 4 IN, 4 OUT of the expansion LOW	-		
62	Mask 4 IN, 4 OUT of the expansion HIGH	-		
75	Hour end of test LOW	-	09 (ex: 09:15:59)	RESULTS AT END OF TEST
76	Hour end of the HIGH	-	0	
77	Minute end of test LOW	-	14	
78	Minute end of test HIGH	-	0	
79	Seconds end of test LOW	-	59	
80	Seconds end of test HIGH	-	0	
81	Day end of test LOW	-	24 (ex: 24/03/17)	
82	Day end of test HIGH	-	0	
83	Month end of test LOW	-	4	
84	Month end of test HIGH	-	0	
85	Year end of test LOW	-	17	
86	Year end of test HIGH	-	0	
87	Program number LOW	-	0 (Prg: 000)	
88	Program number HIGH	-	0	
89	Program following the running one LOW	Table linked	0 (Program not linked)	
90	Program following the running one HIGH	Table linked	0	
91	Kind of test LOW	Table test	0 (Decay)	
92	Kind of test HIGH	Table test	0	
93	Result of test LOW	Table-Results	2 (NO OK)	
94	Result of test HIGH	Table-Results	0	
95	Last phase of test LOW	Table-Phase	12 (Filling phase)	
96	Last phase of test HIGH	Table-Phase	0	
97	Remaining time end of test LOW	-	0 (0 seconds left)	
98	Remaining time end of test HIGH	-	0	
99	Remaining time end of test LOW	-	0	
100	Remaining time end of test HIGH	-	0	
101	Unit measure of remaining time LOW	Table Measure	60 (seconds)	
102	Unit measure of remaining time HIGH	Table Measure	0	
103	Decimal points of remaining time LOW	-	2 (ex: 123.45)	
104	Decimal points of remaining time HIGH	-	0	
105	Sign of Pressure evaluated LOW	0: positive 255 : negative	0	
106	Sign of Pressure evaluated HIGH	-	0	
107	Pressure evaluated LOW	-	70 (ex: 493.4)	
108	Pressure evaluated HIGH	-	19	
109	Pressure evaluated LOW	-	0	
110	Pressure evaluated HIGH	-	0	

111	Unit measure pressure evaluated LOW	Table Measure	0 (mbar)	
112	Unit measure pressure evaluated HIGH	Table Measure	0	
113	Decimal points pressure evaluated LOW	-	1	
114	Decimal points pressure evaluated HIGH	-	0	
115	Sign of Decay evaluated LOW	0: positive 255 : negative	255	
116	Sign of Decay evaluated HIGH	-	0	
117	Decay evaluated LOW	-	40 (ex : - 0.040)	
118	Decay evaluated HIGH	-	0	
119	Decay evaluated LOW	-	0	
120	Decay evaluated HIGH	-	0	
121	Unit measure Decay evaluated LOW	Table Measure	0 (mbar)	
122	Unit measure Decay evaluated HIGH	Table Measure	0	
123	Decimal points Decay evaluated LOW	-	3 (ex: 0.040)	
124	Decimal points Decay evaluated HIGH	-	0	
125	INTERNAL USE	-		
126	INTERNAL USE	-		
127	INTERNAL USE	-		
128	INTERNAL USE	-		
129	INTERNAL USE	-		
130	INTERNAL USE	-		
131	INTERNAL USE	Table Measure		
132	INTERNAL USE	Table Measure		
133	INTERNAL USE	-		
134	INTERNAL USE	-		
135	INTERNAL USE	-		
136	INTERNAL USE	-		
137	INTERNAL USE	-		
138	INTERNAL USE	-		
139	INTERNAL USE	-		
140	INTERNAL USE	-		
159	Loop counter LOW	-		PROFINET
160	Loop counter HIGH	-		
161	Generic warning/error counter LOW	-		
162	Generic warning/error counter HIGH	-		
163	Fatal error counter LOW	-		
164	Fatal error counter HIGH	-		
165	Flag TST read LOW	-	0 :no data 1:data valid 0xFF : data not valid	PARAMETER READ
166	Flag TST read HIGH	-	-	
167	#1 TST Read Value LOW	-	#1 parameter prg:000	
168	#1 TST Read Value HIGH	-	#1 parameter prg:000	
169	#2 TST Read Value LOW	-	#2 parameter prg: 000	
170	#2 TST Read Value HIGH	-	#2 parameter prg: 000	
....	...	-		
199	#32 TST Read Value LOW	-	#32 parameter prg: 000	
200	#32 TST Read Value HIGH	-	#32 parameter prg: 000	
201 .. 225 226 227 228	TST Read Value LOW .. TST Read Value LOW TST Read Value HIGH TST Read Value LOW TST Read Value HIGH	-	... Unit measure pressure L Unit measure pressure H Unit measure decay L Unit measure decay H	PAR. READ EXTENDED
240	Flag TST write LOW	-	0: no data 1: data valid 0xFF : data not valid	WRITE
241	Flag TST write HIGH	-	0	

NOTE :

- All fields marked as "Results at end of test" are updated at the end of a test cycle.
- All fields marked "Status in real time" are update at every microcontroller cycle.
- When a test cycle starts, the results are cleared and are evaluable only at the end of test.
- To understand if a test is finished it is necessary to check the status of the test (register number 3) when it change from "Running" to "Waiting" .
- Counters in the "*Profinet*" bar are used for debug purposes. Generally the loop counter should increase his value about every second and error counters should be set to zero.
- If field "Flag TST read" are valid, it means that "TST Read Value" fields can be evaluated, otherwise there is an error and fields cannot be evaluated. See "Output table" for detailed informations.
- If fields "Flag TST write" are valid , it means that "TST Write Value" fields were written correctly, otherwise there is a writing error. See "Output table" for detailed informations.

32 bit Fields

Please note that values as "Time remaining end of current phase" , "Pressure Evaluated" or Decay Evaluated" are mapped in 4 bytes.

For the decimal conversion if you have 4 bytes ($B0_L$, $B1_H$, $B2_L$, $B3_H$) the calculation is:

$$VALUE = B0_L + (B1_H \times 256) + (B2_L \times 256 \times 256) + (B3_H \times 256 \times 256 \times 256)$$

For insert the right decimal point you have to calculate:

VALUE = VALUE / 10 ^ decimal points

For insert the sign you can calculate

VALUE = - 1 x sign x VALUE

Example:

Position 33 ►value 110 ►$B0_L$
Position 34 ►value 19 ►$B1_H$
Position 35: ►value 0 ►$B2_L$
Position 34 ►value 0 ►$B3_H$

value = 110 + (19x256) + (0x256) + (0x256) = 4974

value = 4974 / 10 ^ 1 = 497.4

value = +497.4

From the table Table Measure is it possible to get the unit measure, for example "0" means "mbar" , "41" means "cc/min" .

Output table

Values are shifted in 8 bit part LOW and 8 bit part HIGH.

To obtain a 16 bit value is necessary to perform the following operation value = (256 * HIGH) + LOW

Position	Description	Reference
1	Program number LOW	0 (change to Prg: 000)
2	Program number HIGH	0
3	Start the current program selected LOW	"255" : START signal , "0" : no signal
4	Start the current program selected HIGH	-
5	Abort the current program in test LOW	"255" : ABORT signal , "0" : no signal
6	Abort the current program in test HIGH	-
7	TST Address read LOW	(Example: 0x22)
8	TST Address read HIGH	(Example : 0x33)
9	TST Quantity of registry to read LOW	(Example: 0x20)
10	TST Quantity of registry to read HIGH	(Example: 0x00)
11	TST ACK command read LOW	255 (enable READ command)
12	TST ACK command read HIGH	0 (default)
13	TST Address write LOW	(Example: 0x24)
14	TST Address write HIGH	(Example: 0x33)
15	TST Value write LOW	0x7B (Example : 123)
16	TST Value write HIGH	0
17	TST ACK command write LOW	255 (enable READ command)
18	TST ACK command write HIGH	0
19	Autozero LOW	"255" : START signal, "0" : no signal
20	Autozero HIGH	-
21	Reset CTP results LOW	"255" : START signal, "0" : no signal
22	Reset CTP results HIGH	-

Output commands must be executed one time and not inserted into a loop cycle

Back to Input Table

NOTE :

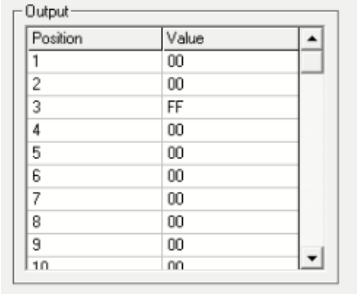
- "START" and "ABORT" signal are toggled.After an "HIGH" signal is necessary to switch the signal "LOW" and give another new "HIGH" to take effect.
- Maximum quantity of register for "TST read" is 32 (0x20)
- All address for "TST write" and "TST read" command are referred to table TST program mapping
- Result for a valid "TST read" are available into the Input table from positions 167 to 200
- TST ACK for "TST write" and "TST read" are toggled. For a new command is necessary a LOW to HIGH transition.
- If a wrong address (or the quantity of registers) of a "TST write" or "TST read" command is send to equipment, the "Generic Warning/Error Counter" is increased by 1.

Reading / Writing Examples

To verify that the data read or written is actual to the one reported on the instrument, you are invited to test the commands by consulting the parameter with the relative TST or SET menu open and verify the correspondence.

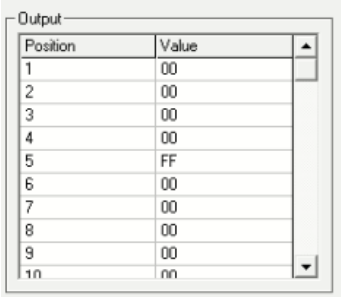
START

OUTPUT : position 3 → 0xFF (for a new START is it necessary to insert a 0x00 value , then 0xFF)



STOP

OUTPUT : position 5 → 0xFF (for a new ABORT it is necessary to insert a 0x00 value, then 0xFF)



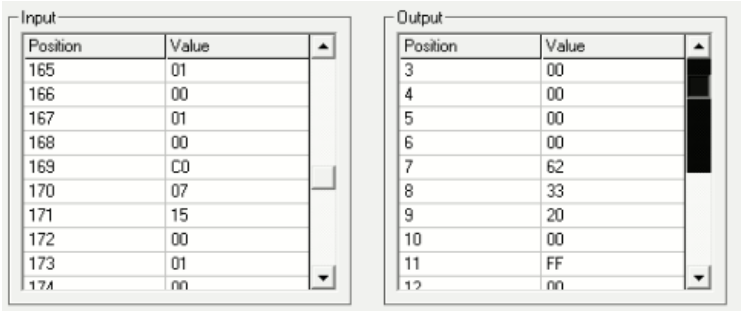
READING TST PARAMETERS

OUTPUT: Prg: 000 → 0x3322 (position 7 -8) , 0x20 : 32 registers , 0xFF enable (position 11-12)

INPUT :

- Data valid (position 165-166) : 0x01
- Kind of test (position 167-168) : 0x01 Obstruction test
- Filling pressure (169-170) : 0xE8 + (0x03 * 0xFF) = 1000 dec
- Tolerance (171-172) : 99 dec

To make a new reading it is necessary to set enable to 0x00 and again to 0xFF



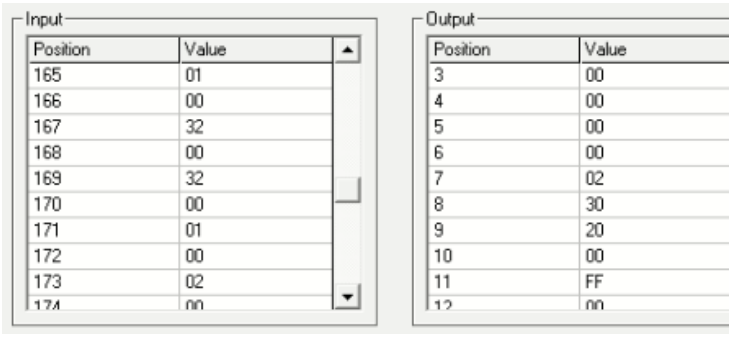
OUTPUT: Prg: 001 → 0x3362 (position 7 -8) , 0x20 : 32 registers , 0xFF enable (position 11-12)

INPUT :

- Data valid (posizione 165-166) : 0x01
- Kind of test (posizione 167-168) : 0x01 Pervietà
- Filling pressure (169-170) : 0xC0 + (0x07 * 0xFF) = 1984
- Tolerance (171-172) : 21

To make a new reading it is necessary to set enable to 0x00 and again to 0xFF

READING SET PARAMETERS

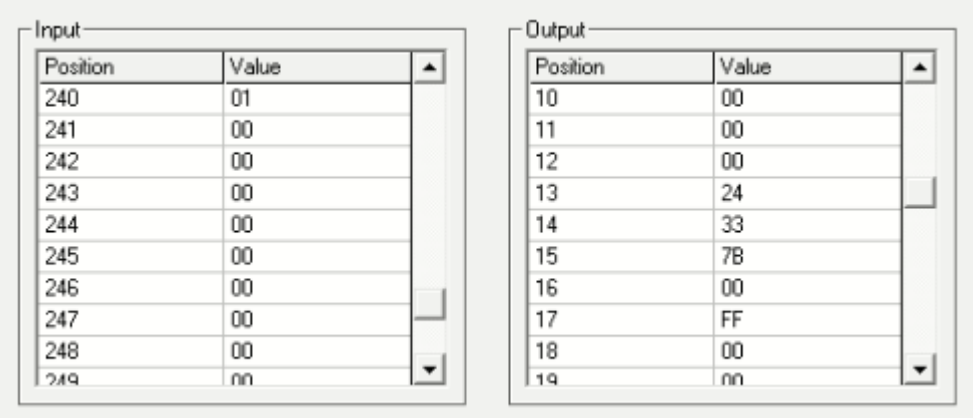


OUTPUT: Address: 0x3002 , 0x20 : 32 register , 0xFF enable (position 11-12)

INPUT :

- Data valid (position 165-166) : 0x01
- Keyboard lighting (position 167-168) : 50%
- Minimum display lighting (position 169-170) : 50%

WRITING TST PARAMETER



OUTPUT: Prg: 000 → Pressure parameter address : 0x3324 (position 13 - 14) , value (position 15-16) , 0xFF enable (position 17-18)

INPUT : position 240 (write ok)

Write “123” as “Filling pressure”

SET parameters of the device

These registers are used to perform read/write actions on the general setting of the Mxxx device. For example is it possible to change the contrast regulation and lightness of the display.

Address hex	Function	Size in Bytes	Range values / Reference
0x3002	Display contrast regulation	2 Bytes	0 – 100
0x3004	Display minimum lightness	2 Bytes	0 – 100
0x3006	Serial address of the device	2 Bytes	0 – FF (hex)
0x3008	Kind of start	2 Bytes	-
0x300A	Language	2 Bytes	-
0x300C	Graph Visualization	2 Bytes	0 : “OFF” , 1: “ON”
0x300E	Label signal duration	2 Bytes	0 – 32727
0x3010	Acoustic signal duration	2 Bytes	0 – 32727
0x3012	General valve delay closing (only flow test)	2 Bytes	0 – 32767
0x3014	Filter pressure direct	2 Byte	0 – 32767
0x3016	Filter pressure VOUT	2 Byte	0 - 32767
0x3018	Direct pressure dec. fac. vis.	2 Byte	0 – 32767
0x301A	Tolerance % on the opposite decay	2 Bytes	0 – 100
0x301C	Try filling attempts	2 Bytes	0 – 32767
0x301E	Stop test on bad result	2 Bytes	0 : “OFF” , 1: “ON”
0x3020	Equalization during settling	2 Bytes	0 : “OFF” , 1: “ON”
0x3022	COM1 mode	2 Bytes	-
0x3024	COM1 baudrate	2 Bytes	-
0x3026	COM2 mode	2 Bytes	-
0x3028	COM2 baudrate	2 Bytes	-
0x302A	Lock the device with password	2 Bytes	0 : “OFF” , 1: “ON”
0x303A	Auto-Zero pressure every	2 Bytes	0 – 32767
0x303E	Change scale threshold	2 Bytes	0 – 32767
0x3036	OutAn0 use	2 Bytes	-
0x3038	OutAn1 use	2 Bytes	-
0x303C	Recharge at % filling time	2 Bytes	0 – 32767
0x3040	Second branch pressure	2 Bytes	0 – 32767
0x3042	Third branch pressure	2 Bytes	0 – 32767
0x3044	End of cycle signal	2 Bytes	0 – 32767
0x3046	Bad management	2 Bytes	0 – 32767
0x3048	Abort management	2 Bytes	0 – 32767
0x304A	Control at % settling time	2 Bytes	0 – 32767
0x307A	Label to print	2 Bytes	0 – 32767
0x307C	Print also linked	2 Bytes	0 : “OFF” , 1: “ON”
0x307E	Print also bad	2 Bytes	0 : “OFF” , 1: “ON”
0x3080	Print also abort	2 Bytes	0 : “OFF” , 1: “ON”
0x3084	Proportional factor	2 Bytes	0 – 32767
0x3086	Derivative factor	2 Bytes	0 – 32767
0x30B4	Result leds max. brightness	2 Bytes	0 – 32767
0x30B6	Automatic start	2 Bytes	0 – 32767
0x30C8	Pressure in economode	2 Bytes	0 – 32767
0x3150	Serial number high	2 Bytes	0 – 32767
0x3152	Serial number low	2 Bytes	0 – 32767

TST parameters of the device

These registers are used to perform read/write actions on a specific parameter of a test program. Every parameter cover a fixed address range area. For example the address 0x3322 is the address of the parameter "Kind of test" of the program number 0.

Address	Parameter Description	Program Number	Decay	Obstruction	Functional Cycles	Flow Test
0x3322	Kind of test	0	X	X	X	X
0x3324	Filling pressure	0	X	X	X	X
0x3326	Pressure tolerance	0	X	X	X	X
0x3328	Kind of filling	0	X	X	X	X
0x332A	Filling phase duration	0	X	X	-	X
0x332C	Settling phase duration	0	X	X	-	X
0x332E	Test phase duration	0	X	X	-	X
0x3330	Discharge phase duration	0	X	X	-	X
0x3332	Reference: **Kind of test**	0	Kind of measurement	Min. pres. Obstruction test	-	Min. admitted flow
0x3334	Reference: **Kind of test**	0	Maximum decay	Max. pres. Obstruction test	-	Max. admitted flow
0x3336	Reference: **Kind of test**	0	Piece's volume	-	-	Pressure>flow compensation
0x3338	Reference: **Kind of test**	0	Offset on the decay	-	-	Temperature mass>volume
0x333A	Bell Time Test **	0	O	O	O	-
0x333C	Bell Decay **	0	O	O	O	-
0x333E	Bell Test Cycles **	0	O	O	O	-
0x3340	Volumetric test time	0	X	O	O	-
0x3342	Tolerance on the measured	0	X	O	O	-
0x3344	Pre-filling pressure	0	X	X	-	-
0x3346	Pre-filling phase duration	0	X	X	-	-
0x3348	Discharge phase duration	0	X	X	-	-
0x334A	Kind of pre-filling	0	X	X	-	-
0x334C	Number of cycles	0	-	-	X	-
0x334E	Work cycle duration	0	-	-	X	-
0x3350	Discharge cycle duration	0	-	-	X	-
0x3352	Program following the running one	0	X	X	X	X
0x3354	Delay on start	0	X	X	X	X
0x3356	Output coupled with the program	0	X	X	X	X
0x3358	Input coupled with the program	0	X	X	X	X
0x335A	Percentage of good	0	X	X	X	X
0x335C	Measure unit of pressure	0	X	X	X	X
0x335E	Decay unit measure	0	X	X	x	x
0x3360	Delay H2 Heater ***	0	O	-	-	-
0x3362	Kind of test	1	X	X	X	X
0x3364	Filling pressure	1	X	X	X	X
0x3366	Pressure tolerance	1	X	X	X	X
0x3368	Kind of filling	1	X	X	X	X
0x336A	Filling phase duration	1	X	X	-	X
0x336C	Settling phase duration	1	X	X	-	X
0x336E	Test phase duration	1	X	X	-	X
0x3370	Discharge phase duration	1	X	X	-	X

0x3372	Reference: **Kind of test**	1	Kind of measurement	Min. pres. Obstruction test	-	Min. admitted flow
0x3374	Reference: **Kind of test**	1	Maximum decay	Max. pres. Obstruction test	-	Max. admitted flow
0x3376	Reference: **Kind of test**	1	Piece's volume	-	-	Pressure>flow compensation
0x3378	Reference: **Kind of test**	1	Offset on the decay	-	-	Temperature mass>volume
0x337A	Bell Time Test **	1	O	O	O	-
0x337C	Bell Decay **	1	O	O	O	-
0x337E	Bell Test Cycles **	1	O	O	O	-
0x3380	Volumetric test time	1	X	O	O	-
0x3382	Tolerance on the measured	1	X	O	O	-
0x3384	Pre-filling pressure	1	X	X	-	-
0x3386	Pre-filling phase duration	1	X	X	-	-
0x3388	Discharge phase duration	1	X	X	-	-
0x338A	Kind of pre-filling	1	X	X	-	-
0x338C	Number of cycles	1	-	-	X	-
0x338E	Work cycle duration	1	-	-	X	-
0x3390	Discharge cycle duration	1	-	-	X	-
0x3392	Program following the running one	1	X	X	X	X
0x3394	Delay on start	1	X	X	X	X
0x3396	Output coupled with the program	1	X	X	X	X
0x3398	Input coupled with the program	1	X	X	X	X
0x339A	Percentage of good	1	X	X	X	X
0x339C	Measure unit of pressure	1	X	X	X	X
0x339E	Decay unit measure	1	X	X	x	x
0x33A0	Delay H2 Heater ***	1	O	-	-	-
0x33A2	Kind of test	2	…	..	..	..
…	…	…	…	…	…	…
0x33E2	Kind of test	3				
…	…					
0x3422	…	4				
…	…					
0x3462	…	5				
…	…					
0x3F62	Kind of test	49	X	X	X	X
…	…	…				
0x3FA2	Delay H2 Heater	49	O	-	-	-
0x3FA4	Kind of test	50	..	..	..	..
…	…	…	…	…	..	..

X Possible

- Not possible

** If the device is **compliance (T8980…)**

*** If the optional **hydrogen** (**T8999**) is enabled

For a complete list of all offsets between programs please refer to the table TST PROGRAM MAPPING

Table-Result of Test

Value Dec	Definition
0	No result
1	Good
2	Bad
3	Good with reserve
4	Inverse decay
5	Bad reference
6	Bad bell
7	Bad flow under threshold
8	Bad pressure over scale
9	Bad VOUT over scale
10	Bad pressure under tolerance
11	Bad pressure over tolerance
12	Bad pressure not reached the level
13	Abort
14	Bad flow over threshold
98	Abort for automations interrupted
99	Test in progress

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Table - Phase of test

Value Dec	Definition
1	Start
2	Delay on start
3	Pre-Filling
4	Pre-Filling
5	Pre-Filling
6	Pre-Filling
7	Discharge pre-filling
8	Discharge pre-filling
9	Discharge pre-filling
10	Discharge pre-filling
11	Filling
12	Filling
13	Reload attempt filling
14	Settling
15	Settling
16	Settling
17	Settling
18	Settling
30	Obstruction test
43	Volume test
50	End of test with GOOD

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Table -Unit measures

Value Dec	Definition
0	Mbar
1	Bar
2	hPa
3	Pa
4	Psi
20	Mbar/s
21	Bar/s
22	hPa/s
23	Pa/s
24	Psi/s
40	Cc/h
41	Cc/min
42	l/h
43	l/min
60	s
61	Min
70	Cc
71	l
80	--
81	%
82	Bps
83	C°
84	Conv/s
85	Prg
86	Chin
87	Chout
88	Volt

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Table - Status

Value Dec	Definition
0	Waiting START
1	Test in progress
2	Autozero
3	Discharge
4	Calibration

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Table – Sub status

Status Value Dec	Sub status Value	Definition
0	Any	No active sub state
1	Any	Follow the table "Phase of test"
2	0	Not used
2	1	Autozero pressure in progress
2	2	Autozero VOUT in progress
2	3	Autozero pressure error
2	4	Autozero VOUT error
3	0	Not used
3	1	Discharge in progress
3	2	Discharge in progress
3	3	Discharge in progress
3	4	Discharge in progress
4	0	Not used
4	1	Calibration in progress
4	2	Calibration in progress
5	0	Not used
5	1	Not used

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Table Results

Status Value Dec	Definition
0	No active results
1	OK
2	NO OK
3	OK with reserve
4	Inverse decay
5	NO OK piece reference
6	NO OK bell test
7	NO OK flow under threshold
8	NO OK pressure over scale
9	NO OK VOUT over scale
10	Pressure under tolerance %
11	Pressure over tolerance %
12	NO OK pressure not reached or kept the level
13	Abort
14	Bad flow over threshold
98	Abort automation not complete
99	Test in progress

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Table Errors

Error mask is a 16 bit value taken from the Status. To understand the meaning of the mask it is necessary to perform a AND-logical with the following bit mask. "Zero" means no error, "One" means error.

Hex Mask	Description
0x0001	FLASH ERROR
0x0002	EEPROM ERROR
0x0004	ERROR FS AD CHANNEL PRESSURE
0x0008	MASK FS AD CHANNEL VOUT
0x0010	MASK ERR VOUT
0x0020	MASK ERROR COUNT PIECES (CTP) *NEGATIVE LOGIC* (bit ON means "NO ERROR", bit OFF means "ERROR"
0x0040	MASK ERROR TEMPERATURE SENSOR
0x0080	MASK ERROR BATTERY (IF PRESENT)
0x0100	MASK ERROR 10V HALF
0x0200	MASK ERROR PRESSURE REGULATOR
0x0400	MASK FS CTP
0x0800	MASK BARRCODE PRESENT ("*One*" means new barcode present, "*Zero*" no barcode in RAM)

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Table Programs Linked

Status Value Dec	Definition
0	Not linked programs
83 ('S')	End of a cycle of linked programs for ABORT or NO OK result
69 ('E')	End sequence of linked programs
76 ('L')	Another program in sequence

Values are set from the parameter "*Prg following the running one*" of TST parameter menu

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Table Kind of Test

Status Value	Definition
0	Leak test (Decay)
1	Obstruction test
2	Functional Cycles
3	H^2
100	Flow test
101	Ramp +
102	Ramp -

Values are set from the parameter "*Kind of test*" of TST parameter menu.

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TST Programs Mapping

Program N.	Address Hex
0	3322
1	3362
2	33A2
3	33E2
4	3422
5	3462
6	34A2
7	34E2
8	3522
9	3562
10	35A2
11	35E2
12	3622
13	3662
14	36A2
15	36E2
16	3722
17	3762
18	37A2
19	37E2
20	3822
21	3862
22	38A2
23	38E2
24	3922
25	3962
26	39A2
27	39E2
28	3A22
29	3A62
30	3AA2
31	3AE2
32	3B22
33	3B62
34	3BA2
35	3BE2
36	3C22
37	3C62
38	3CA2

39	3CE2
40	3D22
41	3D62
42	3DA2
43	3DE2
44	3E22
45	3E62
46	3EA2
47	3EE2
48	3F22
49	3F62
50	413D
51	417D
52	41BD
53	41FD
54	423D
55	427D
56	42BD
57	42FD
58	433D
59	437D
60	43BD
61	43FD
62	443D
63	447D
64	44BD
65	44FD
66	453D
67	457D
68	45BD
69	45FD
70	463D
71	467D
72	46BD
73	46FD
74	473D
75	477D
76	47BD
77	47FD
78	483D
79	487D
80	48BD
81	48FD
82	493D

83	497D
84	49BD
85	49FD
86	4A3D
87	4A7D
88	4ABD
89	4AFD
90	4B3D
91	4B7D
92	4BBD
93	4BFD
94	4C3D
95	4C7D
96	4CBD
97	4CFD
98	4D3D
99	4D7D
100	4DBD
101	4DFD
102	4E3D
103	4E7D
104	4EBD
105	4EFD
106	4F3D
107	4F7D
108	4FBD
109	4FFD
110	503D
111	507D
112	50BD
113	50FD
114	513D
115	517D
116	51BD
117	51FD
118	523D
119	527D
120	52BD
121	52FD
122	533D
123	537D
124	53BD
125	53FD
126	543D

127	547D
128	54BD
129	54FD
130	553D
131	557D
132	55BD
133	55FD
134	563D
135	567D
136	56BD
137	56FD
138	573D
139	577D
140	57BD
141	57FD
142	583D
143	587D
144	58BD
145	58FD
146	593D
147	597D
148	59BD
149	59FD
150	5A3D
151	5A7D
152	5ABD
153	5AFD
154	5B3D
155	5B7D
156	5BBD
157	5BFD
158	5C3D
159	5C7D
160	5CBD
161	5CFD
162	5D3D
163	5D7D
164	5DBD
165	5DFD
166	5E3D
167	5E7D
168	5EBD
169	5EFD
170	5F3D

171	5F7D
172	5FBD
173	5FFD
174	603D
175	607D
176	60BD
177	60FD
178	613D
179	617D
180	61BD
181	61FD
182	623D
183	627D
184	62BD
185	62FD
186	633D
187	637D
188	63BD
189	63FD
190	643D
191	647D
192	64BD
193	64FD
194	653D
195	657D
196	65BD
197	65FD
198	663D
199	667D
200	66BD
201	66FD
202	673D
203	677D
204	67BD
205	67FD
206	683D
207	687D
208	68BD
209	68FD
210	693D
211	697D
212	69BD
213	69FD
214	6A3D

215	6A7D
216	6ABD
217	6AFD
218	6B3D
219	6B7D
220	6BBD
221	6BFD
222	6C3D
223	6C7D
224	6CBD
225	6CFD
226	6D3D
227	6D7D
228	6DBD
229	6DFD
230	6E3D
231	6E7D
232	6EBD
233	6EFD
234	6F3D
235	6F7D
236	6FBD
237	6FFD
238	703D
239	707D
240	70BD
241	70FD
242	713D
243	717D
244	71BD
245	71FD
246	723D
247	727D
248	72BD
249	72FD
250	733D
251	737D
252	73BD
253	73FD
254	743D
255	747D
256	74BD
257	74FD
258	753D

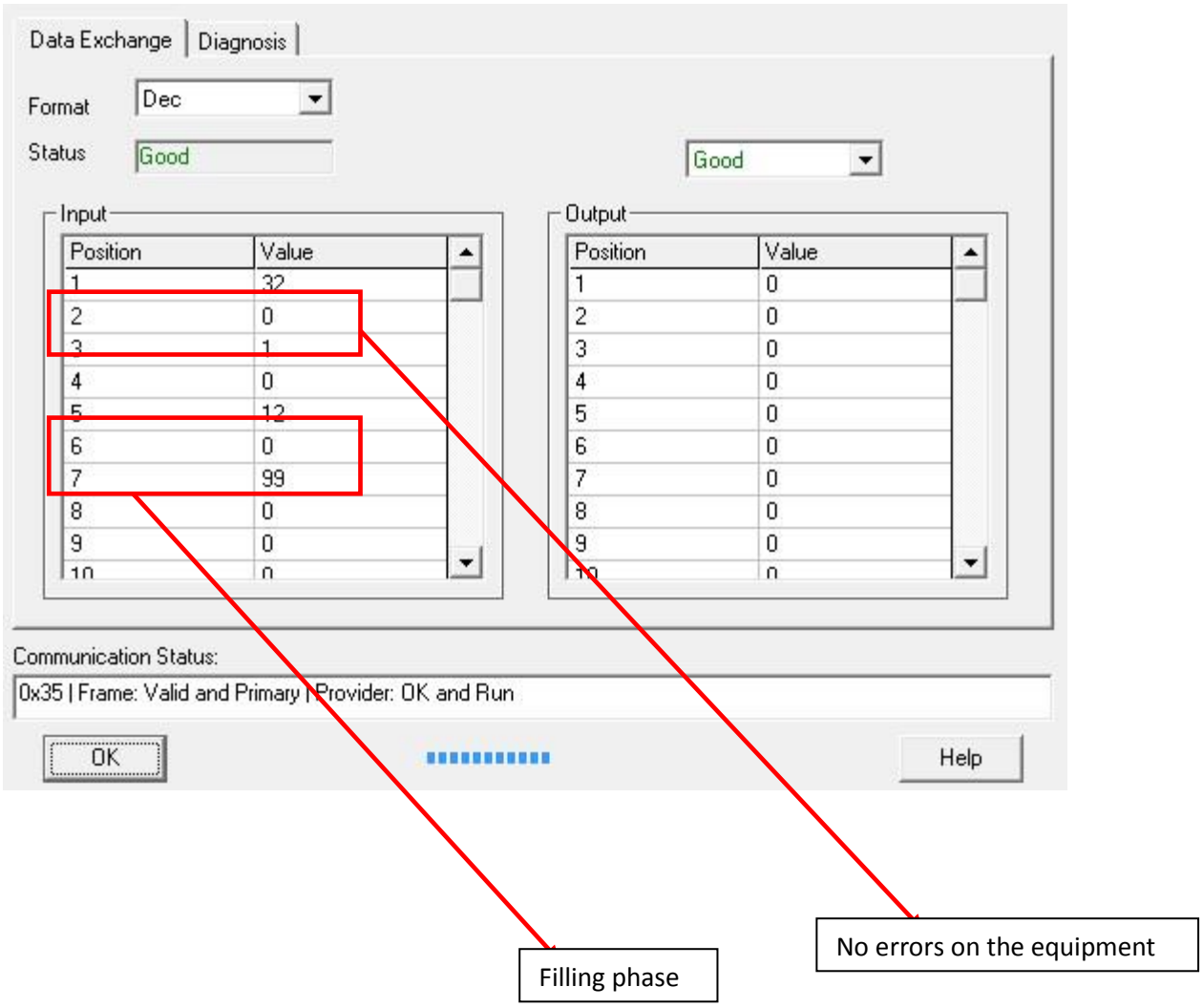
259	757D
260	75BD
261	75FD
262	763D
263	767D
264	76BD
265	76FD
266	773D
267	777D
268	77BD
269	77FD
270	783D
271	787D
272	78BD
273	78FD
274	793D
275	797D
276	79BD
277	79FD
278	7A3D
279	7A7D
280	7ABD
281	7AFD
282	7B3D
283	7B7D
284	7BBD
285	7BFD
286	7C3D
287	7C7D
288	7CBD
289	7CFD
290	7D3D
291	7D7D
292	7DBD
293	7DFD
294	7E3D
295	7E7D
296	7EBD
297	7EFD
298	7F3D
299	7F7D

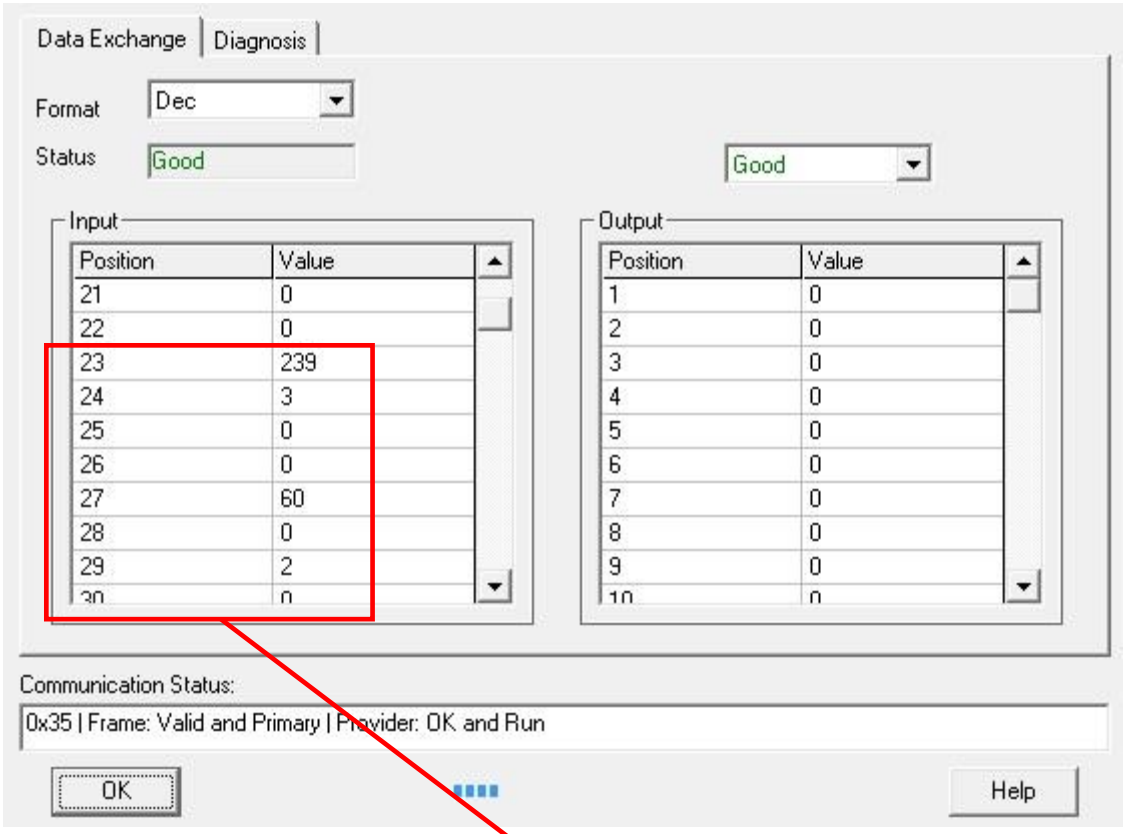
Example

- *0x3322* is the address of the first parameter of the program #0 of TST menu
- *0x3324* is the address of the second parameter of the program #0 of TST menu
- *0x3362* is the address of the first parameter of the program #01 of TST menu
- *0x3002* is the first address of the SET parameters of the menu

Examples of data exchange

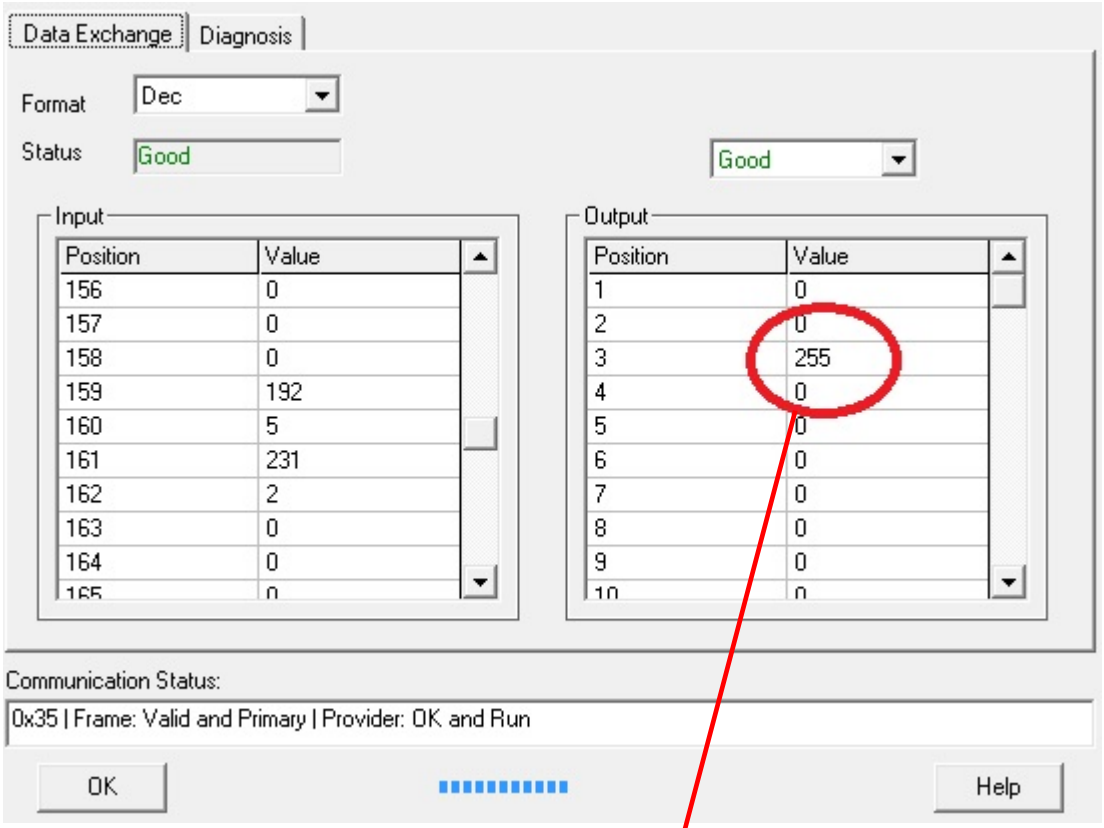
Input





10,07 seconds left to current phase

Output



START current program selected

Example application for PLC

General guidelines for connect a PLC with ForTest are available at the following link:

http://downloads.fortest-leak-testing.it/PROFINET/EN_Notes_for_use_Profinet_UNIGATE_module.pdf

Example application written for PLC Siemens 1200, 1500 in TIA Portal 16 is available at the following link:

http://downloads.fortest-leak-testing.it/PROFINET/Test_Profinet_Fortest.zap16

Changelog

DATE	DESCRIPTION	REVISION
19/06/2017	First revision of this document	Rev01
18/07/2017	Corrections on the fieldbus input / output table	Rev02
21/07/2017	Address correction in the fieldbus menu table	Rev03
22/07/2017	Added examples of input / output	Rev03
05/09/2017	Added new table references and examples	Rev04
04/12/2017	Update appendixtable	Rev05
26/06/2018	Update Configuration image of SET menu	Rev6
28/06/2018	Added TST read and TST write reference	Rev7
03/07/2018	Added TST full mapping table , example application for PLC	Rev8
12/02/2019	Modules and submodules section	Rev9
27/09/2019	Added TST and SET read/write parameters table reference	Rev10
01/03/2021	New examples and input table updating	Rev11
13/07/2021	Update methods for IP change and parameters settings	Rev12

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