Instruction Manual

Turbo Instrument Controller (TIC) Serial Communications

Note: Laptop PC not included

Description	Item Number
TIC Instrument Controller	D397-00-000
TIC Instrument Controller 6-Gauge	D397-01-000
TIC Instrument Controller 6-Gauge Capacitance Manometer	D397-02-000
TIC Turbo Controller 100 W	D397-11-000
TIC Turbo Controller 200 W	D397-12-000
TIC Turbo & Instrument Controller 100 W	D397-21-000
TIC Turbo & Instrument Controller 200 W	D397-22-000

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1 Introduction

1.1 Scope

This manual provides Operation instructions for serial interface communications to the Edwards Turbo Instrument Controller product range, part numbers:

Description	Item Number
TIC Instrument Controller	D397-00-000
TIC Instrument Controller 6-Gauge	*D397-01-000*
TIC Instrument Controller 6-Gauge Capacitance Manometer	*D397-02-000*
TIC Turbo Controller 100 W	*D397-11-000*
TIC Turbo Controller 200 W	*D397-12-000*
TIC Turbo & Instrument Controller 100 W	*D397-21-000*
TIC Turbo & Instrument Controller 200 W	*D397-22-000*

CAUTION

Before using these instructions, ensure that you have a good understanding about the operation of the controller.

1.2 Message basics

The communications to the TIC work on a master/slave principle. The TIC is the slave and will only transmit a message in response to one sent to it. The master, a PC for example, must always start the conversation.

A conversation consists of a message to the TIC and its response back. Having sent a message to the TIC, wait for the reply before continuing.

There are two basic types of message sent to the TIC:

- Command sending information to the TIC (!).
- Query requesting information from the TIC (?).

All messages end with a carriage return.

In multi-drop mode, the ? and ! are preceded by the addressing information.

Characters not enclosed by start (!?) and end (cr) characters will be ignored. Incomplete messages will be ignored if a new start character is received.

1.2.1 Commands

Commands send information to the TIC. These can be literal commands such as 'turn pump on' or setups to be stored by the TIC. Setups hold information about how the TIC should behave such as the conditions under which the vent valve should open.

1.2.2 Queries

Queries request information from the TIC. These can be direct queries of the value of a parameter such as pump speed, or reading the setup value currently in the TIC.

1.2.3 Responses

Responses from the TIC contain either the data requested (=) or the status of the command (*). Note that for commands such as Upload/Download, the action will continue after the response has been received. Also detailed checking is performed by the objects themselves so a good response only guarantees that the message was accepted by the serial communications, correct behaviour must be checked by querying the appropriate attribute. For example write a setup, read it back and check the updates are as requested.

1.2.4 Setup

Some objects have more than one setup, for these objects the config type is sent and returned as the first parameter in the data field.

1.3 DX, nEXT and nXDS pumps

The TIC will pass messages to the DX, nEXT or nXDS pump and return the replies. It limits some of the commands that can be sent directly as the TIC must take account of setups and inputs connected to it. For example, if SYSI is set into the fail condition; the turbo pump must not run so on/off commands directly to the DX, nEXT or nXDS are always ignored, use the TIC turbo object instead.

Under a fault condition the DX and nEXT move through their state machines slightly differently. The TIC adjusts the information from the nEXT so the TIC's states move like the DX for both pump types. On fault the TIC shows both pumps as fault braking until a stop command is issued. At this point the fault is cleared from the pump object 904 and the front panel.

When not using the TIC the main visible difference is that the DX clears its fault bits and fault LED when a stop command is issued. The nEXT does not clear them until both a stop and then a start command are issued.

1.4 Communications timings

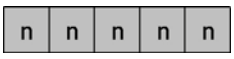
Because of the complexity of the product precise message timings are not defined, however, the following are provided for guidance:

- Basic messages — less than 100 mSecs
- Messages to DX, nEXT or nXDS (dependent on DX or nEXT behaviour) — less than 200 mSecs
- Suggested timeout in master — 500 mSecs
- Upload Turbo (DX/nEXT) — less than 2 secs
- Download Turbo (DX/nEXT) — less than 4 secs

1.5 Object IDs

This sub-section summarises the protocol, based on the use of object IDs, to identify sources and destinations in messages.

Objects can be physical items such as gauges and pumps, or virtual items such as software modules and data records. Each object is allocated a unique identification number, although two instances of a particular item will both have the same ID. In a message, the Object ID consists of 1 - 5 ASCII digits representing a number between 1 - 65535, as shown below:



Data fields contain command codes, parameter values or response codes, and will vary in length and format according to the message type. If there is more than one item in the data field, each item is separated by a semi colon(;).

A returned response code consists of 1 or 2 characters representing a number between 0_99. A code of '0' always means 'OK'. Other codes can be used to indicate various error conditions:

r	r

Where several items are linked together using multiple RS232 lines radiating from a hub, a 'multi-drop' identifier is prefixed to each message. It is composed of a '#', followed by a 2 character Destination ID, a colon, and a 2 character Source ID:

#	d	d	:	s	s

1.6 TIC serial protocol messages

!	C	n	n	n	n	n	sp	m	cr	**GENERAL COMMAND**
*	C	n	n	n	n	n	sp	r	r	cr NORMAL (or ERROR) RESPONSE
!	S	n	n	n	n	n	sp	data		cr **SETUP COMMAND**
*	S	n	n	n	n	n	sp	r	r	cr NORMAL (or ERROR) RESPONSE
?	S	n	n	n	n	n	cr			**QUERY SETUP**
*	S	n	n	n	n	n	sp	r	r	cr ERROR RESPONSE
=	S	n	n	n	n	n	sp	data		cr NORMAL RESPONSE
?	V	n	n	n	n	n	cr			**QUERY VALUE**
*	V	n	n	n	n	n	sp	r	r	cr ERROR RESPONSE
=	V	n	n	n	n	n	sp	data		cr NORMAL RESPONSE

1.6.1 TIC serial protocol - multi-drop prefix to a message

#	d	d	:	s	s	!	C	n	n	n	n	n	sp	m	cr

1.6.2 PC serial

This covers operations specific to the PC serial link covering control, monitoring and setup of all sections of the TIC and the attached pumps.

Objects in the DX, nEXT or nXDS pump can be read via the TIC at their normal object ID and the TIC will pass the messages on and return the reply, refer to DX, nEXT or nXDS requirements Section 1.3. Wait for the reply before sending in another message even if the new message is for the TIC or 'other' pump.

The following objects can be accessed via the PC serial comms:

Table 1 - Objects accessed via the PC serial comms

Object ID	Object	Operations		Notes
800 +	DX, nEXT and nXDS objects			Routed, refer to DX, nEXT and nXDS pump manual
901	Node	?S !S	0 - 98	Read multi-drop Set multi-drop Config type not needed
902	TIC Status	?V	T - see turbo state B - see backing state G - see gauge state R - see relay state Alert ID of 902 Highest priority level in system NB just the state value is returned between;	System status, depends on unit type - TC T;B;R1;R2;R3;Alert ID; priority TIC T;B;G1;G2;G3;R1;R2;R3;Alert ID; priority IC G1;G2;G3;R1;R2;R3;Alert ID; priority IC6 G1;G2;G3;G4;G5;G6;R1;R2;R3;R4;R5;R6; Alert ID; priority e.g. TIC 4;4;0;11;0;0;4;0;0;0
		?S	max 80 chars, typical 40	Read system string - TICxxx; SW Ver; Ser Num; PIC SW ver Config type not needed
903	Unused			
904	Turbo Pump	?V	State 0 - 7 - see Section 1.7.8 Alert - see Section 1.7.3 Priority - see Section 1.7.2	Pump status - state; alert ID; priority
		!C	On =1 Off = 0	Turn pump on/off
		?S !S	see pump type list	Read pump type Config type = 3
			Master - object ID gauge 1/2/3 Units type - 59, 66 see snvt list Setpoint - volts 0.000 - 9.999, pressure float. Enable 1 = on, 0 = off	Read slave setup - master; units type; on setpoint; off setpoint, enable Write slave setup - master; units type; on setpoint; off setpoint, enable Config type = 4
			Delay 0 - 99 mins	Read start delay Write start delay Config type = 21
905	Turbo speed	?V	Value 0.0 - 110.0%	Turbo speed - value; alert ID; priority
		?S !S	Times 1 - 30; 0 - 30 mins	Read start fail time; droop fail time Write start fail time; droop fail time Config type not needed

Table 1 - Objects accessed via the PC serial comms (continued)

Object ID	Object	Operations		Notes
906	Turbo power	?V	Value 0.0 - 300.0 w (typ)	Turbo power - value; alert ID; priority
907	Turbo normal	?V	State 0 = no, 4 = yes	At normal speed - state; alert ID; priority
908	Turbo standby	?V	4 = in standby 0 = not in standby	In standby mode
		!C	1 = set standby 0 = set not standby	Set standby mode
909	Turbo cycle time	?V	Value - 0-65535 hours	Time period turbo has been on - value; state; alert ID; priority
910	Backing Pump	?V	State 0 - 4	Pump status - state; alert ID; priority
		!C		Turn pump on/off
		?S !S	see pump type list	Read pump type Config type = 3
			None = 0 On stop = 1 On 50% = 2	Read backing sequence options - none/on stop/50% Set backing sequence options Config type = 70
911	Backing speed	?V	Value 0.0 - 100.0%	Backing speed - value; alert ID; priority
912	Backing power	?V	Value 0.0 - 50.0 w (typ)	Backing power - value; alert ID; priority
913	Gauge 1	?V	Value - pressure (see gauge type) or voltage 0.000 to 11.000 volts.	Gauge reading and state - value; units type; state; alert ID; priority
		?S !S	Master - object ID gauge 1/2/3 and turbo speed. Units type - 59, 66, 81 see snvt list. Setpoints to suit units type and master. volts 0.000 - 9.999, pressure float, pascals speed 0 - 99.	Read slave setup - master; units type; on setpoint; off setpoint, enable Write slave setup - master; units type; on setpoint; off setpoint, enable Config type = 4
			Gauge type - see gauge list	Read gauge type - e.g. AIMX Config type = 5
			Gas type - see gas list. Filter 1 = on, 0 = off.	Read gauge setup - gas type (volt); filter on/off Set gauge setup - gas type (volt); filter on/off Config type = 7
			0 = 1000 1 = 2000 mbar	Read ASG range Set ASG range Config type = 6
			Gauge name	Read user gauge name - 4 characters 0-9, A-Z Set user gauge name Config type = 68
		!C	Commands - see command list	Accept new gauge On/off Zero/calibrate/degas

Table 1 - Objects accessed via the PC serial comms (continued)

Object ID	Object	Operations		Notes
914	Gauge 2	?V ?S !S !C	see gauge 1	see gauge 1
915	Gauge 3	?V ?S !S !C	see gauge 1	see gauge 1
916	Relay 1	?V	State 0 - 4	Relay state on/off - state; alert ID; priority
		?S !S	Master - object ID gauge 1/2/3 Units type - 59, 66, 81 see snvt list Setpoints to suit units type	Read slave setup - master; units type; on setpoint; off setpoint, enable Set slave setup- master; units type; on setpoint; off setpoint, enable Config type not needed
		!C	On = 1 Off = 0	Turn relay on/off
917	Relay 2	?V ?S !S	see relay 1	see relay 1
918	Relay 3	?V ?S !S	see relay 1	see relay 1
919	PS Temperature	?V	273.0 - 400.0 celsius offset by 274 i.e. freezing water = 274	Power supply temperature value - value; alert ID; priority
920	Internal Temperature	?V	see PS temperature	TIC internal temperature value - value; alert ID; priority
921	Analogue out	?V	0 - 255	Analogue out value - value; alert ID; priority
		?S !S	Object ID gauge 1/2/3, turbo speed	Read analogue out source Set analogue out source Config type not needed
922	External vent valve	?V	State 0 - 4	Vent valve state on/off - value; alert ID; priority
		?S !S	On stop = 0 On 50% = 1	Read vent options - on stop/50% Set vent options Config type not needed
923	Heater band	?V	Value 0-2100 mins State 0 - 4	Heater band time, state on/off - value; state; alert ID; priority
		!C	0 = off, 1 = on	On/off Heater band
		?S !S		Read on time 0-35 hours Set on time 0-35 hours Config type not needed
924	External Air Cooler	?V	State 0 - 4	Air cooler state on/off - value; alert ID; priority
		?S !S	Turbo slaved = 1 Permanent = 0	Read permanently on or turbo slaved Write permanently on or turbo slaved Config type not needed

Table 1 - Objects accessed via the PC serial comms (continued)

Object ID	Object	Operations		Notes
925	Display contrast	?S !S	-5 - 15	Read contrast setting Set contrast setting Config type not needed
926	Configuration Operations	!C	see command list	Default TIC
				Default Turbo send to DX or nEXT pump
				Load config to Turbo (DX or nEXT) Load config from Turbo (DX or nEXT)
928	Lock	?S !S	?S-Locked = 1 Released = 0 !S-see config list	Lock/release config setup
			?S-Locked = 1 Released = 0 !S-see config list	Lock/release front panel
929	Pressure Units	?S !S	kPa = 1 mbar = 2 Torr = 3	Read display pressure Units - kPascal/mbar/ Torr Set display pressure Units - kPascal/mbar/ Torr Config type not needed
930	PC comms	?S !S	232 = 0 485 = 1	Read PC comms to RS232/RS485 Set PC comms to RS232/RS485 Config type not needed
931	Default screen	?S !S	All = 0 Three gauges = 1 Gauge 1 = 2 Gauge 2 = 3 Gauge 3 = 4 Turbo only = 5 One gauge = 6 Six gauges = 7 Turbo + one gauge = 8	Read default screen Set default screen Config type 15 Options 2,3,4 are only available to D39700640F and earlier. Options 6,7 are only available to D39700640G and later. TC - option 5 only TIC - option 0,1,2,3,4,5,6 IC - options 1,6 IC6 - options 1,6,7
			Possible IDs are - 913, 914, 915, 934, 935, 936 and 0 = none	Read one gauge order Set one gauge order Config type 71 S931 71;Position 1 ID;Pos 2 ID;Pos 3 ID; Pos 4 ID; Pos 5 ID;Pos 6 ID Gauge IDs can be in any order and can be repeated. 0 (zero) ID entry means don't show this position.
			As above	Read three gauge order Set three gauge order Config type 72 S931 72;Position 1 ID;Pos 2 ID; Pos 3 ID; Pos 4 ID;Pos 5 ID;Pos 6 ID Gauge IDs can be in any order and can be repeated. 0 (zero) ID entry means don't show this position but there must be a minimum of three non-zero entries.

Table 1 - Objects accessed via the PC serial comms (continued)

Object ID	Object	Operations		Notes
932	Fixed/Float ASG	?S !S	Float = 1 Fixed = 0	Read Float/fixed display (ASG) Write Float/fixed display (ASG) Config type not needed
933	System (TIC and TC only)	?S !S	0 = no 1 = yes	Read/write System On/Off setup Config type not needed The message consists of sections of Object ID; system on; system off. Any number of whole sections can be sent up to the maximum of 12. Invalid object IDs will be ignored. You can send just the sections you wish to alter e.g. !S933 915;1;1;910;1;0cr The actual structures for each kind of unit are shown below. ?S answers will be in this order and return all relevant entries. TIC Turbo 904;on;off; Back 910;on;off; Gauge1 913;on;off; Gauge2 914;on;off; Gauge3 915;on;off; Relay1 916;on;off; Relay2 917;on;off; Relay3 918;on;off e.g. = S933 904;0;1;910;1;0;913;0;0;914;0;915;0;0;916;1;1;917;0;0;918;0;0cr TC Turbo 904;on;off; Back 910;on;off; Relay1 916;on;off; Relay2 917;on;off; Relay3 918;on;off; e.g. = S933 904;0;1;910;1;0;916;1;1;917;0;0;918;0;0cr Recommend read/modify/write sequence to reduce errors.
		!C	0 = off, 1 = on	On/off System System on will turn on objects marked with a 1 in the setup on field System off will turn off objects marked with a 1 in the setup off field
		?V	State 0 - 4	System status - state; alert ID; priority

Table 1 - Objects accessed via the PC serial comms (continued)

Object ID	Object	Operations		Notes
934	Gauge 4	?V	Value - pressure (see gauge type) or voltage 0.000 to 11.000 volts.	Gauge reading and state - value; units type; state; alert ID; priority
		?S !S	Master - object ID gauge 1/2/3 and turbo speed. Units type - 59, 66, 81 see snvt list. Setpoints to suit units type and master. volts 0.000 - 9.999, pressure float, speed 0 - 99.	Read slave setup - master; units type; on setpoint; off setpoint, enable Write slave setup - master; units type; on setpoint; off setpoint, enable Config type = 4
			Gauge type - see gauge list	Read gauge type - e.g. AIMX Config type = 5
			Gas type - see gas list. Filter - 1 = on, 0 = off.	Read gauge setup - gas type (volt); filter on/off Set gauge setup - gas type (volt); filter on/off Config type = 7
			0 = 1000 **1 = 2000 mbar**	Read ASG range Set ASG range Config type = 6
			Gauge name	Read user gauge name - 4 characters 0-9, A-Z Set user gauge name Config type = 68
			0 = 0.05 1 = 0.1 2 = 0.2 3 = 1 .... 10 = 2000 2 = mBar 3 = Torr	Read CapMan setup - range;units Write CapMan setup - range;units Config type = 73

Table 1 - Objects accessed via the PC serial comms (continued)

Object ID	Object	Operations		Notes
934	Gauge 4	?S !S	Filament 1 = 1 2 = 2 Head 1 = A 2 = B Emission 0 = Auto 1 = 100uAmp 2 = 1 mAmp 3 = 10 mAmp Restrike 0 = off 1 = on Constant1 0.020 to 0.480 Constant2 0.020 to 0.480	Read IGC setup Write IGC setup Filament;head;emission;restrike;constant1; constant2 Config type = 74 e.g. !S913 74;1;1;0;0;0.1;0.1
		!C	Commands - see command list	Accept new gauge On/off Zero/calibrate/degas
935	Gauge 5		See Gauge 4	See Gauge 4
936	Gauge 6		See Gauge 4	See Gauge 4
937	Relay 4	?V ?S !S	See Relay 1	See Relay 1
938	Relay 5	?V ?S !S	See Relay 1	See Relay 1
939	Relay 6	?V ?S !S	See Relay 1	See Relay 1
940	Gauge Values	?V	Position 1-6. Value - pressure (see gauge type) or voltage 0.000 to 11.000 volts.	For each attached gauge <Position byte>;<Gauge value>; Examples Reply for 1 gauge connected at position 2 =V940 2;3.9441e+02; Reply for 3 gauges connected at positions 2, 3 and 5 with gauge 2 in voltage mode and gauge 5 not ON (e.g. OFF, error, striking etc) =V940 2;6.546;3;2.7245e-04;5; 9.9000e+09;

Note: *The pump shall accept the wildcard multi-drop address 99.*
The pump shall accept the wildcard object ID 0 for a ?S and return information from the TIC Status object 902.

The following are examples of abbreviations and codings, with their meanings, which appear in subsequent paragraphs.

Table 2 - Abbreviations

Abbreviation	Meaning
r	returned error code - see Table 3
String	may have several ASCII characters
d	decimal ASCII character
h	hexadecimal ASCII character
ck	checksum (1 byte)
cr	carriage return

1.6.2.1 Node object 901

Store Setup	**To TIC**	!	S	9	0	1	sp	d	cr
	From TIC	=	S	9	0	1	sp	r	cr

where d is the multi-drop address to be stored in EEPROM.

1.6.2.2 Node object 902

Query Setup	**To TIC**	?	S	9	0	2	cr								
	From TIC	=	S	9	0	2	sp	Str1	;	Str2	;	Str3	;	Str4	cr

Query setup returns a data string in the following format:

TIC;Dxxxxxxxx;serial number;PIC s/w ver

where 'TIC' is a fixed string for this pump, Dxxxxxx is the software version number fixed by the software, serial number is a string loaded during production, PIC s/w ver is the PIC software version.

Query Value	**To TIC**	?	V	9	0	2	cr										
	From TIC	=	V	9	0	2	sp	t	b	g 1	g 2	g 3	r 1	r 2	r 3	a	p	cr

System state of key items on the TIC, state value from Turbo, backing, gauge 1, gauge 2, gauge 3, relay 1, relay 2, relay 3, alert ID of object 902 and highest priority on the TIC.

1.6.2.3 Turbo pump object 904

Query Value	**To TIC**	?	V	9	0	4	cr						
	From TIC	=	V	9	0	4	sp	s	;	a	;	p	cr

where s is the state of the pump, a is the alert ID and p is the priority. Number of characters per parameter is as required to represent the value.

Store Command	**To TIC**	!	C	9	0	4	sp	d	cr
	From TIC	*	C	9	0	4	sp	r	cr

where d is 0 = pump off, 1 = pump on.

Query Setup	To TIC	?	S	9	0	4	sp	3	cr		
	From TIC	=	S	9	0	4	sp	3	;	p	cr

where 3 is the config type and p is the pump type.

Query Setup	To TIC	?	S	9	0	4	sp	4	cr									
	From TIC	=	S	9	0	4	sp	4	;	m	;	p	;	n	;	f	;	e	cr

where 4 is the config type, m is the master object, p is pressure '59' or voltage '66', n is the on setpoint, f is the off setpoint and e is enabled '1' or disabled '0' e.g.

=S904 913;59;5.1e-2;4.9e-1;1

=S904 914;66;3.62;4.34;1.

1.7 Additional information

1.7.1 Serial comms response codes (*Cnnn x, *S, *V)

Table 3 - Serial comms response codes

Value	Meaning
0	no error
1	Invalid command for object ID
2	Invalid query/command
3	Missing parameter
4	Parameter out of range
5	Invalid command in current state - e.g. serial command to start or stop when in parallel control mode
6	Data checksum error
7	EEPROM read or write error
8	Operation took too long
9	Invalid config ID

1.7.2 Priority

OK = 0
warning = 1
alarm = 2/3

1.7.3 Alert ID

No Alert = 0

ADC Fault = 1
ADC Not Ready = 2

Over Range	= 3
Under Range	= 4
ADC Invalid	= 5
No Gauge	= 6
Unknown	= 7
Not Supported	= 8
New ID	= 9
Over Range	= 10
Under Range	= 11
Over Range	= 12
Ion Em Timeout	= 13
Not Struck	= 14
Filament Fail	= 15
Mag Fail	= 16
Striker Fail	= 17
Not Struck	= 18
Filament Fail	= 19
Cal Error	= 20
Initialising	= 21
Emission Error	= 22
Over Pressure	= 23
ASG Cant Zero	= 24
RampUp Timeout	= 25
Droop Timeout	= 26
Run Hours High	= 27
SC Interlock	= 28
ID Volts Error	= 29
Serial ID Fail	= 30
Upload Active	= 31
DX Fault	= 32
Temp Alert	= 33
SYSI Inhibit	= 34
Ext Inhibit	= 35
Temp Inhibit	= 36
No Reading	= 37
No Message	= 38
NOV Failure	= 39
Upload Timeout	= 40
Download Failed	= 41
No Tube	= 42
Use Gauges 4-6	= 43
Degas Inhibited	= 44
IGC Inhibited	= 45
Brownout/Short	= 46
Service due	=47

1.7.4 SNVT values

VOLTAGE	66 - float
PRESSURE	59 - float (Pascals only)
PERCENT	81

Note: *Pressure values used in the configuration setups and in the logging will be in Pascals. They are not stored or displayed in the selected units.*

1.7.5 Command list

Device Off	= 0	//general off/on
Device On	= 1	
Gauge Off	= 0	
Gauge On	= 1	
Gauge New_Id	= 2	
Gauge Zero	= 3	
Gauge Cal	= 4	
Gauge Degas	= 5	
Load Defaults	= 576	
Upload	= 0	//to TIC
Download	= 1	//from TIC

1.7.6 State

Off State	= 0
Off Going On State	= 1
On Going Off Shutdown State	= 2
On Going Off Normal State	= 3
On State	= 4

1.7.7 Active gauge states

Gauge Not connected	= 0
Gauge Connected	= 1
New Gauge Id	= 2
Gauge Change	= 3
Gauge In Alert	= 4
Off	= 5
Striking	= 6
Initialising	= 7
Calibrating	= 8
Zeroing	= 9
Degassing	= 10
On	= 11
Inhibited	= 12

1.7.8 Full pump states

TIC's representation of an attached pump's state.

Stopped	= 0
Starting Delay	= 1
Accelerating	= 5
Running	= 4
Stopping Short Delay	= 2
Stopping Normal Delay	= 3
Fault Braking	= 6
Braking	= 7

1.7.9 Gas types

Nitrogen	= 0
Helium	= 1
Argon	= 2
Carbon Dioxide	= 3
Neon	= 4
Krypton	= 5
Voltage	= 6

1.7.10 Gauge types

Unknown Device	= 0
No Device	= 1
EXP_CM	= 2
EXP_STD	= 3
CMAN_S	= 4
CMAN_D	= 5
TURBO	= 6
APGM	= 7
APGL	= 8
APGXM	= 9
APGXH	= 10
APGXL	= 11
ATCA	= 12
ATCD	= 13
ATCM	= 14
WRG	= 15
AIMC	= 16
AIMN	= 17
AIMS	= 18
AIMX	= 19
AIGC_I2R	= 20
AIGC_2FIL	= 21
ION_EB	= 22
AIGXS	= 23
USER	= 24
ASG	= 25

1.7.11 Pump types

No Pump	= 0	
EXDC Pump	= 1	
EXT75DX Pump	= 3	
EXT255DX	= 4	
Mains Backing Pump	= 8	
Serial Pump	= 9	//temporary until serial comms receives ID from pump
nEXT - 485	= 10	//TIC only supports this in parallel form
nEXT - 232	= 11	
nXDS	= 12	
Not yet identified	= 99	

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Return the equipment or components for service

Before you send your equipment to us for service or for any other reason, you must send us a completed Declaration of Contamination of Vacuum Equipment and Components – Form HS2. The HS2 form tells us if any substances found in the equipment are hazardous, which is important for the safety of our employees and all other people involved in the service of your equipment. The hazard information also lets us select the correct procedures to service your equipment.

We provide instructions for completing the form in the Declaration of Contamination of Vacuum equipment and Components – Procedure HS1.

If you are returning a vacuum pump, note the following:

- If a pump is configured to suit the application, make a record of the configuration before returning the pump. All replacement pumps will be supplied with default factory settings.
- Do not return a pump with accessories fitted. Remove all accessories and retain them for future use.
- The instruction in the returns procedure to drain all fluids does not apply to the lubricant in pump oil reservoirs.

Download the latest documents from www.edwardsvacuum.com/HSForms/, follow the procedure in HS1, fill in the electronic HS2 form, print it, sign it, and return the signed copy to Edwards.

Note: *If we do not receive a completed HS2 form, we will not accept the return of the equipment.*

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