tGard Installation Instructions

Description:
tGard provides a compact "Integrated Control & Safety System". Its modularity allows the configuration of electrical gate switches, mechanical trapped keys, simple machine control systems or combinations of all three.

Important:
tGard elements can be configured to produce many different functional products, which can be integrated into safety and / or machine control systems. As such **tGard** products and the systems they are part of need to be installed and commissioned by suitably competent and qualified personnel, whom have read and understood the whole of this document, prior to commencing the installation.
These installation instructions must be retained.
A risk assessment must be carried out before installation. This product is not to be used as a mains isolator. When a unit is added to any electrical installation, it must meet the requirements of the applicable local standards, (e.g. IEC or EN). All the voltages used within the **tGard** circuits must be derived from a safety extra low voltage power supply (SELV). Any modification or deviation from these instructions invalidates all warranties. Fortress Interlocks Ltd. accept no liability whatsoever for any situation arising from misuse or misapplication of this product.

Tools / Fixings / Cables Required:
2 x M5 Cap head screw (refer to mounting diagrams for lengths).
1 x Hex driver to suit M5 screws (3mm across flats).
1 x M5 T-Nut / tapped hole per fixing / M5 Nut
Thread locking compound.
2 x M5 Nuts / tapped holes and screws per actuator, (Refer to mounting diagrams for screw lengths).
M5 tap when fixing to a plate and not using nuts.
1 x Electrical (approx 3mm X 0.5mm) flat screwdriver (required when using self wiring option).
Ø 5.5mm Drill (when fixing to plate with nuts) or
Ø 4.2mm Drill (when tapping plate).

Functional checking:
The following checks must be made during system commissioning:
1. Check all safety functions;
Access to a guarded area is only granted when the machine's motive power is removed safely. Any E-Stop brings the machine to an Emergency stop.
2. Check that every electrical I/O element activates or indicates the machine controls as desired. Including machine cannot run with door open.
If you have any questions or queries of any nature please contact the Fortress Distributor who will be pleased to advise and assist.

Service and inspection:
Regular (minimum) weekly inspection of the following is necessary to ensure trouble-free, lasting operation:
•Correct switching function
•Loose cable connections
•Material degradation
•Debris and accelerated wear
•Sealing
•Tampering
•Alignment.

Maintenance & Repair:
If any problems are discovered during inspection, individual elements or complete configurations can be replaced by Fortress. Any modifications must undergo a full commissioning test. **tGard** contains no user serviceable parts, within the elements. If lubrication of a head or mechanical lock is required use WD40. Do not use dry lubricant. The frequency of lubrication / cleaning will depend on the environment. Any mechanical element must be replaced after 1 Million operations. Illuminating element must be replaced after 100,000 hours that the lamp has been on for.

Environmental Specification	Table 1
Ambient Temperature	0°C to 40°C
Max. Relative Humidy	93(+/-3)% without any dew on the device
Ingress Protection	IP65
Vibration	10-150Hz Amplitude 0.35mm 1 octave / per min, 20 cycles each axis
Shock	½ sine wave acceleration 10N duration 16mS, 1000 cycles in each axis

Protection Against Environmental Influences
A lasting and correct safety function requires that the unit be protected against the ingress of foreign bodies such as swarf, sand, blasting shot, etc. The unit is to be mounted away from the machine, or by the use of anti-vibration mountings, in order to avoid the effects of vibration, shock and bump.

Safety Data		
Standards	EN13849-1:2008 EN13849-2:2012 EN62061:2005 EN14119:2013	
Certifications	CE marked for all applicable directives	
Category	Cat. 3, PLe (EN/ISO 13849-1) and SIL2 (EN/IEC 62061) Can be used as part of a PLe / Cat. 4 / SIL3 system	
Functional Safety Data	B10d (for whole tGard device, which will contain multiple elements)	5,000,000

Disposal:
tGard does not contain any certified hazardous materials so should be disposed of as general waste and recycled wherever possible.
Liability coverage is voided under the following conditions:
•If these instructions are not followed.
•Misapplication or use outside of recommended specifications in this sheet.
•Non-compliance with safety regulations.
•Installation not carried out by competent personnel.
•Non-implementation of functional checks.
•Tampering.

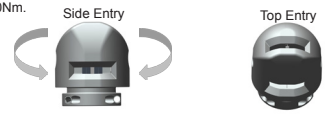
Fortress Interlocks Ltd. reserves the right to modify the design at any time and without notice.

Override / Reset Key
DO NOT LEAVE OVERRIDE / RESET KEY IN PLACE!
Always keep in a secure place, under management control, as it allows access to areas that may have a residual hazard, and may result in incorrect operation of some devices.

Mounting tGard:
1. Choose optimal mounting position:
tGard should be mounted in an environment within the specifications stated in Table 1.
The mounting location should also be away from, or protected against influences such as mechanical collision (door stop required), machine vibration, debris, direct sunlight and sources of electrical interference. Make sure that the gap around the perimeter of the guard, when closed (Safety Circuits Closed), does not exceed the limits specified in En13857 & En953. When used as a door / gate lock, the maximum retention force is 2500N.

2. If the configuration incorporates a locking head and door actuator go to step 3 otherwise skip to step 4.

3. Remove 2 x Head screws and rotate the head into the desired orientation. Replace head screws and tighten to 2.0Nm.



3.1. The **TAF** actuator suits internal mounting on frame-less doors. It can be used in all mounting positions, but brackets may be required.

3.2. The **TAH** actuator is designed to be utilised for hinged door applications, without the need for additional brackets.

3.3. The **TAS** actuator is designed to be utilised for sliding door applications, without the need for additional brackets.

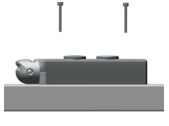
3.4. A **TAS** can be converted into a **TAH** on site (and vice versa). Remove the two M3 screws that retain the actuator (a special pin hex tool will be required to do this which can be purchased separately from Fortress). Remove the actuator and back plate spring. Replace actuator, back plate spring and M3 screws in new location. Use locktite on M3 screws.

3.5. The **TEH** actuator is designed for hinged door applications, without the need for additional brackets.

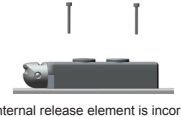
3.6. TEH Handing
This unit can have the handing changed on site by following this procedure below:
1. Remove the 3 x M3 pozi-drive screws retaining the silver handle.
2. Remove the handle, the rose plate that retains the handle and its associated drive coupler.
3. Repeat steps 1 & 2 for the silver knob ensuring the drive couplers are not mixed up (they must stay with their handle).
4. Refit the silver handle to the opposite side taking care to ensure that when the handle is horizontal the actuator is out.
5. Now refit the silver knob. Rotate the drive coupler 90° so that the silver knob can withdraw the actuator but cannot push the actuator back out. **It is essential to use locktite on the 3 x M3 pozi-drive screws holding on the silver knob.**

4. Prepare panel / door frame for mounting:
When plate mounting, the plate must be solid metal and a minimum thickness of 3mm.

4.1. For front of panel mounting
•For mounting to extruded aluminium frame position 1 off M5 T-nut (that are designed to suit the frame used).



•**For plate mounting:** drill Ø5.5 mm element & actuator fixing holes, if fixing with nuts or drill Ø4.2 mm fixing holes if tapping the plate (plate must be >6mm thick if tapping), as per drilling diagram.



4.2. When an Internal release element is incorporated in the stack a 10mm clearance hole must be drilled to accommodate the push release post at the back of the unit. To remove the red push button, pull down the spring away from the red push buttton and fit a 5mm spanner across the flats. You can now unscrew the red push button. Once the unit has been insterted through a 10mm hole the red push button should be refitted with locktite.

In applications where there is little support for the post (for example when fitted to flat plate guarding) it is recommended that additional support is provided for the post to prevent it becoming damaged in the event of a sideway impact (with for example with a tool trolley). This is not necessary when the post passes through guarding material of 25mm or thicker (for example 40mm Aluminium extrude fencing).
The unit should be installed so that it is not possible to reach the escape release button from outside the safeguarded area.

5. All screws must be securely fixed in place screws with thread locking compound (applied to female thread).

6. All fixings must be torque tightened to 2.5 Nm.

Trapped Key Systems
Where trapped keys are incorporated into the system, spare or master keys must be securely controlled.

Electrical connection tGard:
Make sure that the electrical supply is isolated prior to connecting to it.

Description:
tGard incorporates safety circuits and standard I/O in a single product. The safety circuits and control circuits (standard I/O) are separate through all of the element. There are a selection of different connection "base" elements that enable the connection of just the safety circuits, just control circuits or both the safety and the control circuits, in a variety of configurations.

Installation:
Check that the voltage of the machine's power supply (control circuits) is 24V DC (SELV) (to UL6950 & EN7671 & EN50178). **tGard** will work at +/-10% of the nominal supply voltage.The electrical system must incorporate circuit protection for the supply circuit, using a quick acting (F) device (rating 1.6A).

Electrical guidelines:
Control element with inputs / outputs (I/O), such as pushbuttons / lamps / selector switches must be physically configured nearest the base. **Table 2** shows how many I/O connections can be made using the different types of connector, and
Table 3 shows each core element I/O requirements.

Safety Circuit description and I/O allocation:
The safety circuits are made up of two, independent, normally closed (N/C) circuits. They are both closed when the machine is in operation. There are a number of element that can open these safety circuits. All of these element use positively guided, force disconnect contacts. Refer to table 4 for base element pin assignments. The safety circuits must be connected to a Safety Relay or PLC in accordance with the installation instructions of the manufacturer, to provide the safety function. The voltage on the safety circuits should always be SELV. Both safety circuits must include over-current protection, via 200mA fast blow fuses. Non-safety functions in core elements, such as push button and lamp elements operate with a common power supply.
A push button in the stack will have an output (from the stack) associated with it, whilst a Lamp in the stack will have an Input to the stack to drive it. The I/O pins on the connector are set to either Inputs or Outputs, depending on the elements used on the stack. Please note that an external monitor has to perform a diagnostic function (compare both channels), in order to fulfill the safety requirements of CAT. 4/PLe and SIL 3.

Switch Ratings	
Safety Switches	DC13: Le=0.5A, Ue=24V DC AC15: Le=1A, Ue= 24V AC
Monitoring Switches	DC13: Le=0.5A, Ue=24V DC
Push Buttons	Max operating current 100mA & 24V

Pin Assignment
A. Input / Output (Control)
I/O are assigned starting at the physically lowest element (i.e. the element nearest the base) first. Working with the first element the Input (e.g. lamp) is assigned first followed by the output (e.g. button). Once all inputs & outputs have been assigned for an element (using the first available I/O) the process continues for the next element in the configuration (working its way towards the head). For elements with multiple I/O, **Table 3 (overleaf)** shows which is assigned first.

B. Safety Circuits
The hierarchy for Safety Circuits is:
1. Head Safety Circuits (TSM element)
2. Solenoid Safety Circuits (when they are independent as in a FU or FL element).
3. E-Stop Safety Circuits (when they are independent as in a TET / TEP/ TEM / TEI).
4. When "series" e-stops are used (TEC/TEW/TED/TEV) these are wired in series with the TSS circuits.

Table 2. (I/O relative to tGard)

Part No.	Type	QD Connector		Safety	Max No. I/O
TQ1	QD	5 Pin	M12	Yes	0
TQ2	QD	8 Pin	M12	No	5
TQ3	QD	8 Pin	M12	Yes	1
TQ4	QD	12 Pin	M23	No	9
TQ5	QD	12 Pin	M23	Yes	5
TQ7	QD	14 Pin	7/8" UN2	Yes	7
TQ8	QD	19 Pin	M23	Yes	12
TQ9	QD	19 Pin	M23	Yes x 2	8
TW1	Selfwire	12 Terminals		Yes	6
TW3	Selfwire	24 Terminals		Yes x 2	14
TW4	Selfwire	24 Terminals		Yes x 6	10

AS-i introduction
The TEBB4 and TEBB8 base modules allow you to connect all of the features of tGard to an AS-i bus. The tGard stack will be a slave and must be connected as part of a complete AS-i (for control only) or AS-i Safety at Work (if it includes safety elements) network; full details of the network requirements can be found at http://www.as-interface.com/knowledge-base.
The tGard slave, with the complete AS-i network, allows the controller to set bits in the AS-i master to drive stack inputs and read bits in the AS-i master that represent the state of stack outputs. The safety nodes monitor the two contacts of a safety element; when appropriate the node transmits a unique, rolling pattern of 8, 4 bit numbers. An AS-i Safety Monitor on the network can be configured to check the pattern from safety slaves and put an output in to the safe state when the codes are not correctly received.
Previous sections of this manual are relevant to AS-i stacks; the following sections give additional information relevant only to AS-i connected stacks.

AS-i Addressing
A TEBB4 can use up to 2 AS-i addresses; 1 control and 1 safety. TEBB8 can use up to 4 addresses; 2 control and 2 safety. To maximise available bus addresses, the AS-i base module will be configured for the required stack so only the required nodes are seen on the bus. The control node uses extended addressing allowing up to 64 addresses on one bus; all safety nodes use standard addressing
When delivered each node in the stack will have been assigned incrementing addresses, starting at 0. The safety nodes will be assigned first according to the precedence as described in 'Pin Assignment' section 'B. Safety Circuits'. The control nodes will then be assigned addresses, the lowest address corresponding to the control elements nearest the base module.
The nodes are addressed via the AS-i network interface. Use an external programming device to set the required addresses. Please note it is not necessary to connect the Aux supply whilst addressing the unit. NEVER SET NODES IN THE SAME STACK TO THE SAME ADDRESS. Contact your local Fortress representative if this is done.

AS-i Profiles				
	IO	ID	ID1	ID2
Safety	7	B	-	F
I/O	7	A	7	7

AS-i Electrical Specifications	
AS-i Current	≤135mA
AS-i Supply	26.5 - 31.6V
Aux Current	≤400mA
Aux Supply	24V +/- 10% (PELV or SELV)

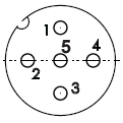
Note: The Aux supply is only required when a solenoid lock is included in the stack.

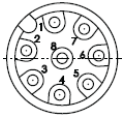
AS-i bit assignment
Each control node can has up to 4 inputs and 4 outputs. The bits will be allocated as per the hardwired tGard stack; outputs from the stack will be represented by bits DI0-DI3, inputs to the stack will be represented by DO0-DO3. Allocation will start with bit 0 of the lowest addressed control node, when all input or output bits have been used on that node, allocation will continue with the next addressed control node.
The solenoid lock, when included in the stack, will always be controlled by DO0 of address 0 (the safety node associated with the safety switches element).
Setting the DO bit will drive 24V into the tGard input.
A 24V output from the tGard stack will cause the relevant DI bit to be set.
Each safety node transmits its safety codes on DI0-DI3; DI0 and DI1 represent the first safety circuit, DI2 and DI3 represent the second safety circuit in the corresponding tGard element. Both bits will be 0 when the safety circuit is open. If monitoring the state of safety switches from an AS-i master, please note, valid safety codes include values where a single pair of the bits is both 0.

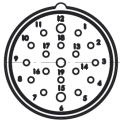
Table 4. Pin Assignments for Quick Disconnect

Pins										
Part No.	TQ1	TEBB4 / 8	TQ2	TQ3	TQ4	TQ5	TQ7	TQ8	TQ9	Pin Assignment
Number of Pins	5	5	8	8	12	12	14	19	19	
Connector Size	M12	M12	M12	M12	M23	M23	7/8" UN2	M23	M23	
# of Safety Circuits	2	-	0	2	0	2	2	2	4	
# of Control I/O	0	-	5	1	9	5	7	12	8	
	SC 1	AS-i +	I/O 0	SC 1	+24v	+ 24v	I/O 3	SC 1	SC 1	1
	SC 2	Aux -	+24v	+24v	I/O 0	SC 1	I/O 2	SC 2	SC 2	2
	SC 1	AS-i -	Earth	Earth	0 v	0 v	I/O 1	SC 1	SC 1	3
	SC 2	Aux +	I/O 1	SC 2	I/O 1	SC 2	+ 24v	SC 2	SC 2	4
	Earth	Earth	I/O 2	SC 1	I/O 2	SC 1	SC 2	I/O 0	I/O 0	5
			I/O 3	SC 2	I/O 3	SC 2	0 v	0 v	0 v	6
			0v	0 v	I/O 4	I/O 0	I/O 6	I/O 1	I/O 1	7
			I/O 4	I/O 0	I/O 5	I/O 1	I/O 5	I/O 2	I/O 2	8
					I/O 6	I/O 2	I/O 4	I/O 3	I/O 3	9
					I/O 7	I/O 3	SC 1	I/O 4	I/O 4	10
					I/O 8	I/O 4	I/O 0	I/O 5	I/O 5	11
					Earth	Earth	SC 2	Earth	Earth	12
							SC 1	I/O 6	I/O 6	13
							Earth	I/O 7	I/O 7	14
								I/O 8	SC 3	15
								I/O 9	SC 4	16
								I/O 10	SC 3	17
								I/O 11	SC 4	18
								+24v	+24v	19

Key
SC = Safety Circuit
I/O = Input or Output
QD = Quick Disconnect (connector at base)





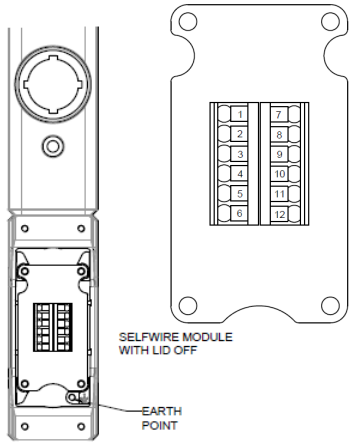


TQ1 / TEBB4 /8	TQ2/3	TQ4/5	TQ7	TQ8/9

Table 4a. Terminal Assignments for Self Wire Bases

Pins				
Part No.	TW1	TW3	TW4	Pin Assignment
Number of Pins	12 + Earth	24 + Earth	24 + Earth	
No.of Safety Circuits	2	4	6	
No. of Control I/O	6	14	10	
	+ 24v	+ 24v	+ 24v	1
	0v	0v	0v	2
	SC 1	SC 1	SC 1	3
	SC 2	SC 2	SC 2	4
	SC 1	SC 1	SC 1	5
	SC 2	SC 2	SC 2	6
	I/O 0	I/O 0	I/O 0	7
	I/O 1	I/O 1	I/O 1	8
	I/O 2	I/O 2	I/O 2	9
	I/O 3	I/O 3	I/O 3	10
	I/O 4	I/O 4	I/O 4	11
	I/O 5	I/O 5	I/O 5	12
		I/O 6	I/O 6	13
		I/O 7	I/O 7	14
		I/O 8	I/O 8	15
		I/O 9	I/O 9	16
		I/O 10	SC 5	17
		I/O 11	SC 6	18
		I/O 12	SC 5	19
		I/O 13	SC 6	20
		SC 3	SC 3	21
		SC 4	SC 4	22
		SC 3	SC 3	23
		SC 4	SC 4	24
	Earth	Earth	Earth	

Selfwire 12 Way - Pin Assignment - TW1



Selfwire 24 Way - Pin Assignment - TW3 & TW4

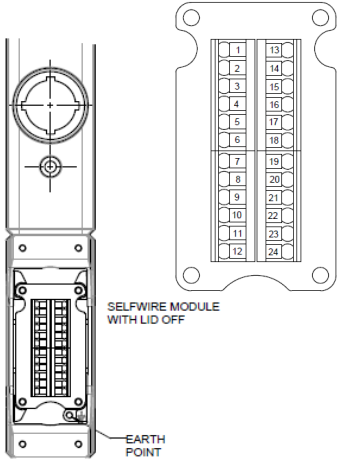


Table 6. Quick Disconnect Mating Cable Pin Assignments

Part No.	Cable-_M-TQ1			Cable-_M-TQ2 / TQ3				Cable-_M-TQ4 / TQ5				Cable-_M-TQ7			Cable-_M-TQ8 / TQ9			
No. Pins	5			8				12				14			19			
Connector	M12			M12				M23				MIN SIZE I			M23			
Pin #	Wire Colour		TQ1 Function	Wire Colour		TQ2 Function	TQ3 Function	Wire Colour		TQ4 Function	TQ5 Function	Wire Colour		TQ7 Function	Wire Colour		TQ8 Function	TQ9 Function
1	Brown		SC1 in	White		I/O 0	SC1 in	Brown		+24v	+24v	Grey / Pink		I/O 3	Violet		SC1 in	SC1 in
2	White		SC2 in	Brown		+24v	+24v	Brown/ White		I/O 0	SC1 in	White / Green		I/O 2	Red		SC2 in	SC2 in
3	Blue		SC1 out	Green		Earth	Earth	Blue		0v	0v	White / Yellow		I/O 1	Grey		SC1 out	SC1 out
4	Black		SC2 out	Yellow		I/O 1	SC2 in	White		I/O 1	SC2 in	Brown		+24v	Red/ Blue		SC2 out	SC2 out
5	Grey		Earth	Grey		I/O 2	SC1 out	Green		I/O 2	SC1 out	Brown / Yellow		SC2 in	Green		I/O 0	I/O 0
6				Pink		I/O 3	SC2 out	Yellow		I/O 3	SC2 out	Blue		0v	Blue		0v	0v
7				Blue		0v	0v	Grey		I/O 4	I/O 0	Yellow		I/O 6	Grey/ Pink		I/O 1	I/O 1
8				Red		I/O 4	I/O 0	Pink		I/O 5	I/O 1	Green		I/O 5	White/ Green		I/O 2	I/O 2
9								Red		I/O 6	I/O 2	Pink		I/O 4	White/ Yellow		I/O 3	I/O 3
10								Black		I/O 7	I/O 3	White		SC1 in	White/ Grey		I/O 4	I/O 4
11								Violet		I/O 8	I/O 4	Red / Blue		I/O 0	Black		I/O 5	I/O 5
12								Green/ Yellow		Earth	Earth	Brown / Green		SC2 out	Green/ Yellow		Earth	Earth
13												Grey		SC1 out	Yellow/ Brown		I/O 6	I/O 6
14												Red		Earth	Brown/ Green		I/O 7	I/O 7
15															White		I/O 8	SC3 in
16															Yellow		I/O 9	SC4 in
17															Pink		I/O 10	SC3 out
18															Grey/ Brown		I/O 11	SC4 out
19															Brown		+24v	+24V

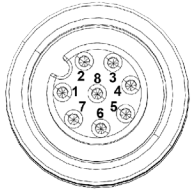
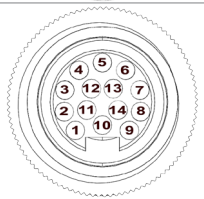
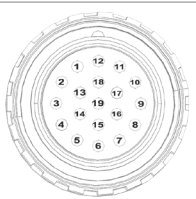
Part No.	Pin Heads
Cable-_M-TQ1	
Cable-_M-TQ2 / TQ3	
Cable-_M-TQ4 / TQ5	
Cable-_M-TQ7	
Cable-_M-TQ8 / TQ9	

Table 3 I/O Assignments

Step	Area	Part No	Element	Extra Info			Number of "Bays" Used	tGard Input (I)	tGard Output (O)	Order Assigned	Element operates on safety circuits
1	Actuators	TAF	Fixed Actuator				0	0	0	-	No
		TAH	Hinged Actuator				0	0	0	-	No
		TAS	Sliding Actuator				0	0	0	-	No
		THB	Handle - Blank (no Actuator)				0	0	0	-	No
		TEN	Handle Actuator (No red handle)				0	0	0	-	No
		TEH	Handle Actuator				0	0	0	-	No
2	Head	THC	Cap				0	0	0	-	No
		THM	Head				0	0	0	-	No
		THF	Head + Fixed Actuator								
		THH	Head + Hinged Actuator								
		THS	Head + Sliding Actuator								
		THE	Head + Handle Actuator (No red handle)								
		THN	Head + Handle Actuator				0	0	0	-	No
3	Internal Release	TRX	Standard 60mm Internal Release				1	0	0	-	No
		TRZ	Variable Length Internal Release				1	0	0	-	No
4	Safety Lock	TSN	Standard Safety Lock (No Key)				1 (per lock)	0	0	-	No
		TGN	Master Safety Lock (No Key)				1 (per lock)	0	0	-	No
5	Access Lock	TAB	Standard Access Lock (No Key)				1 (per lock)	0	0	-	No
		TQB	Master Access Lock (No Key)				1 (per lock)	0	0	-	No
6	Safety Switches & Solenoids	TSM	Safety Switch				1	0	1	-	Yes x 2
		TSS	Safety Switch (No Monitor or LED)				1	0	0	-	Yes x 2
		TSP	Safety Switch with extra head retention force				1	0	1	-	Yes x 3
		TSMDU	Safety Switch & Solenoid	PTU	Option 1	24v = locked	2	1	2	Input to tGard stack (to operate solenoid) assigned first, then output from solenoid monitor then finally output from TSM monitor (where fitted)	Yes x 2
		TSMDL	Safety Switch & Solenoid	PTL	Option 1	24v = locked					Yes x 2
		TSSEU	Safety Switch (No mon.) & Solenoid	PTU	Option 2	0v = locked			1		Yes x 2
		TSSEL	Safety Switch (No mon.) & Solenoid	PTL	Option 2	0v = locked					Yes x 2
		TSMEU	Safety Switch & Solenoid	PTU	Option 2	0v = locked			2		Yes x 2
		TSMEL	Safety Switch & Solenoid	PTL	Option 2	0v = locked					Yes x 2
		TSMFU	Safety Switch & Solenoid	PTU	4 Channel	24v = locked			2		Yes x 4
		TSMFL	Safety Switch & Solenoid	PTL	4 Channel	24v = locked					Yes x 4
7	e-Stops	TEC	E-Stop	Twist		Series Wiring	1	0	0	-	Yes x 2 (Series)
		TEW	E-Stop	Pull		Series Wiring	1	0	0	-	Yes x 2 (Series)
		TED	E-Stop	Twist	Monitored	Series Wiring	1	0	1	-	Yes x 2 (Series)
		TEV	E-Stop	Twist	Illuminated	Series Wiring	1	1	0	-	Yes x 2 (Series)
		TET	E-Stop	Twist		Indi Wiring	1	0	0	-	Yes x 2
		TEP	E-Stop	Pull		Indi Wiring	1	0	0	-	Yes x 2
		TEM	E-Stop	Twist	Monitored	Indi Wiring	1	0	1	-	Yes x 2
		TEI	E-Stop	Twist	Illuminated	Indi Wiring	1	1	0	-	Yes x 2
8	Safety Re-Start	TSR	Blue Re-Start Switch				1	0	0	-	Yes 1NO/1NC
		TS3	Green Re-Start Switch				1	0	0	-	Yes 1NO/1NC
9	Blank	TEB	Blank (To allow expansion in future)				1	0	0	-	No
10	Control	TP1	1 NO Push Buttons	Red	Illuminated		1	1	1	Input to tGard stack (LED) assigned first	No
		TP2		Yellow	Illuminated		1	1	1		No
		TP3		Green	Illuminated		1	1	1		No
		TP6		Blue	Illuminated		1	1	1		No
		TP7		White	Illuminated		1	1	1		No
		TG1		Red	Illuminated	Protruding	1	1	1		No
		TG2		Yellow	Illuminated	Protruding	1	1	1		No
		TG3		Green	Illuminated	Protruding	1	1	1		No
		TG6		Blue	Illuminated	Protruding	1	1	1		No
		TG7		White	Illuminated	Protruding	1	1	1		No
		TJ1		Red	Illuminated	Latching	1	1	1		No
		TJ2		Yellow	Illuminated	Latching	1	1	1		No
		TJ3		Green	Illuminated	Latching	1	1	1		No
		TJ6		Blue	Illuminated	Latching	1	1	1		No
		TJ7		White	Illuminated	Latching	1	1	1		No
		TU1		Red	Illuminated	Volt Free	1	1	2		No
		TU2		Yellow	Illuminated	Volt Free	1	1	2		No
		TU3		Green	Illuminated	Volt Free	1	1	2		No
		TU6		Blue	Illuminated	Volt Free	1	1	2		No
		TU7		White	Illuminated	Volt Free	1	1	2		No
		TPB		Black			1	0	1	-	No
		TPR		Red			1	0	1	-	No
		TPG		Green			1	0	1	-	No
		TPW		White			1	0	1	-	No
		TPY		Yellow			1	0	1	-	No
		TPZ		Blue			1	0	1	-	No
		TGB		Black		Protruding	1	0	1	-	No
		TGR		Red		Protruding	1	0	1	-	No
		TGG		Green		Protruding	1	0	1	-	No
		TGW		White		Protruding	1	0	1	-	No
		TGY		Yellow		Protruding	1	0	1	-	No
		TGZ		Blue		Protruding	1	0	1	-	No
		TMB		Black		Mushroom	1	0	1	-	No
		TUB		Black		Volt Free	1	0	2	-	No
		TUR		Red		Volt Free	1	0	2	-	No
		TUG		Green		Volt Free	1	0	2	-	No
		TUW		White		Volt Free	1	0	2	-	No
		TUY		Yellow		Volt Free	1	0	2	-	No
		TUZ		Blue		Volt Free	1	0	2	-	No
		TXB	1 NO & 1 NC Non-Illuminating Pushbuttons	Black			1	0	2	-	No
		TXR		Red			1	0	2	-	No
		TXG		Green			1	0	2	-	No
		TXW		White			1	0	2	-	No
		TXY		Yellow			1	0	2	-	No
		TXZ		Blue			1	0	2	-	No
		TSZ	1 NO & 1 NC Blue Independantly Wired Switch	Blue			1	1	2	-	No
		TLB	LED Lamp	Blue			1	1	0	-	No
		TLG		Green			1	1	0	-	No
		TLR		Red			1	1	0	-	No
		TLW		White			1	1	0	-	No
		TLY		Yellow			1	1	0	-	No
		T2E	2 Position Selector Switch	Latching	illuminated		1	1	1	Input to tGard stack (LED) assigned first	No
		T2F		Momentary	illuminated		1	1	1		No
		T2A		Latching			1	0	1	-	No
		T2D		Momentary			1	0	1	-	No
		TK1		Latching		Key	1	0	1	-	No
		TK3		Momentary		Key	1	0	1	-	No
		T2V	1 NO & 1 NC 2 Position Selector Switch	Latching			1	0	2	-	No
		T3A	3 Position Selector Key Switch	Latching			1	0	2	Clockwise tGard output assigned first	No
		T3D		Momentary			1	0	2		No
		T3E		Latching	illuminated		1	1	2	LED assigned first followed by Clockwise output	No
		T3F		Momentary	illuminated		1	1	2		No
		TK7		Latching			1	0	2	Clockwise output assigned first	No
		T3H	3 Position Selector Switch	Momentary / Latching			1	1	2	Clockwise output assigned first. Clockwise - 40° momentary , normally open Anti-clockwise - 90° latching, normally closed, individually wired.	No
		TV4	Potentiometer	10K Independently Wired			1	1	2	Input - Wiper. Clockwise End assign first	No
11	Base	TBF	Foot				0	0	0	-	No
		TQ1	QD	5 Pin M12			0	0		-	Yes
		TQ2	QD	8 Pin M12			0	5		-	No
		TQ3	QD	8 Pin M12			0	1		-	Yes x 2
		TQ4	QD	12 Pin M23			0	9		-	No
		TQ5	QD	12 Pin M23			0	5		-	Yes x 2
		TQ7	QD	14 Pin 7/8" UN2			0	7		-	Yes x 2
		TQ8	QD	19 Pin M23			0	12		-	Yes x 2
		TQ9	QD	19 Pin M23			0	8		-	Yes x 2
		TW1	Selfwire	12 Terminals			0	6		-	Yes x 2
		TW3	Selfwire	24 Terminals			0	14		-	Yes x 2
		TW4	Selfwire	24 Terminals			0	10		-	Yes x 6
		TEBB4	AS-i Base	5 Pin M12			1	4	4	-	Yes x 2
		TEBB8	AS-i Base	5 Pin M12			1	8	8	-	Yes x 4
12	Keys	TKS	Key Standard				0	0		0	No
		TKM	Key Master				0	0		0	No
13	Legend Plates	TWL	Legend Plates for Control Elements				0	0		0	No

Fixing Hole Dimension	
Body Length (No of Elements)	**Dimension mm**
1	50
2	100
3	150
4	200
5	250
6	300
8	400
10	500