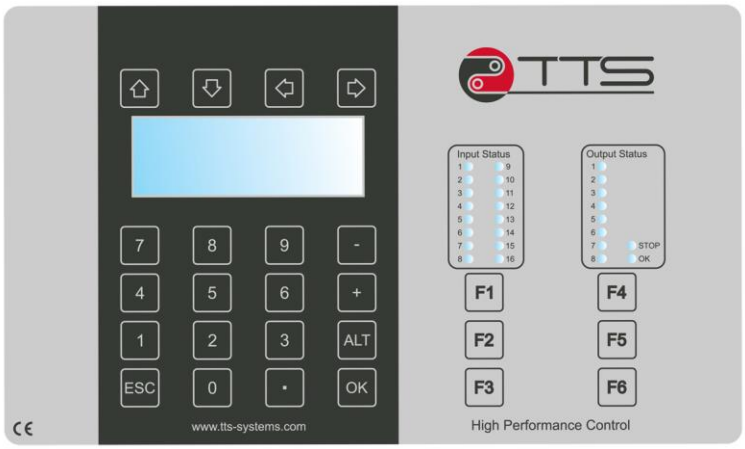
High Performance Tension Controller
HPTC

Electrical Connection Manual



TTS Systems Limited
14, Highpoint Business Village, Henwood, Ashford, Kent, TN24 8DH

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Electrical Overview

Electrical connections to the HPTC vary according to how you wish to use the controller in your application.

If you wish to deviate away from the approach we have provided, please contact your systems engineer for further guidance.

We strongly recommend that a qualified electrical installer carries out this work. Refer to your installers electrical schematic for application specific wiring detail.

The following pages provide information on how to connect the controllers electrically.

The minimum wiring required is:

- A 24 Volt DC Power Supply
- 3 Digital inputs
- 1 Analogue input source for the measured value
- 1 Analogue Output to the actuator, typically an E/P convertor

The controller will be in hold mode when C2-1 is low. This permits access to certain parameters that can be only adjusted when the machine is not running. This also allows the analogue outputs to be switched OFF for example during a changeover when the expired reel needs to be free running. A present starting pressure can be applied to the brake which will be present in this mode.

The control function will initiate when C2-1 is taken high. In normal use this input is under the control of the machine run relay contact however a manual switch can be used but is not recommended.

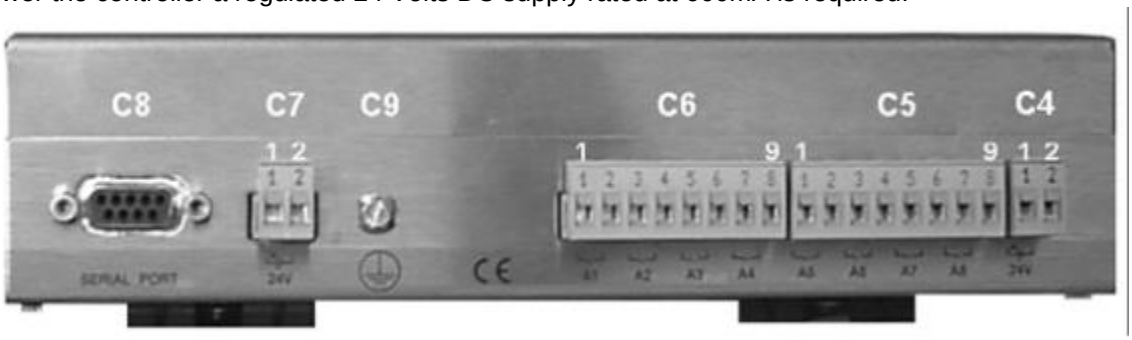
The controller has two fail safe digital inputs that will need connecting. These may be hard wired to enable these inputs but be aware their functions will be ignored by the controller software. These are C2-2 [Dead Stop / E-Stop] and C2-3 [Fast Stop / Web Break].

Dead Stop will send a 10V output to the analogue output[s] to put full air pressure onto a brake[s] meaning that the web could potentially break. Fast Stop will apply a percentage output over a period of time to the brake to bring under a more controlled situation such as a web break detection.

If these inputs are relay controlled, then the fault must be cleared before the controller will function.

Power Supply Connections

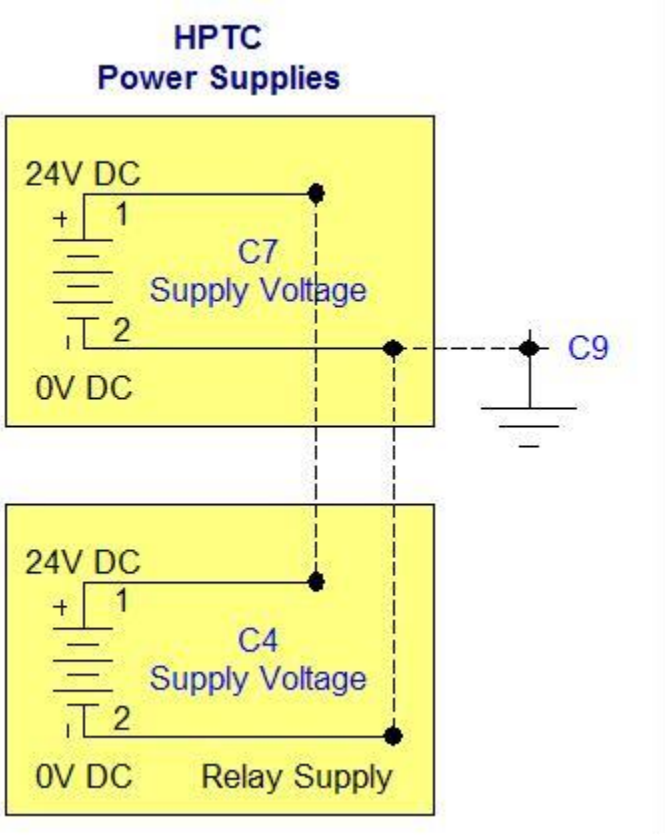
To power the controller a regulated 24 Volts DC supply rated at 600mA is required.



Terminal	Function
C7-1	+24 Volts DC Regulated
C7-2	24 Volts DC Return

To power the auxiliary relays a regulated 24 Volts DC supply rated at 200mA is required.
This can be powered in parallel with the main supply input as shown in the diagram.

Terminal	Function
C4-1	+24 Volts DC Regulated
C4-2	24 Volts DC Return


HPTC
Power Supplies
24V DC
+
1
C7
Supply Voltage
2
0V DC
C9
24V DC
+
1
C4
Supply Voltage
2
0V DC
Relay Supply

Analogue Input Functions

External Set point

0...10 Volt DC signal representing the tension / demand value required.
This input is only valid when the appropriate parameter in the system screens is set to external.
Otherwise the value entered via the keyboard will be used.

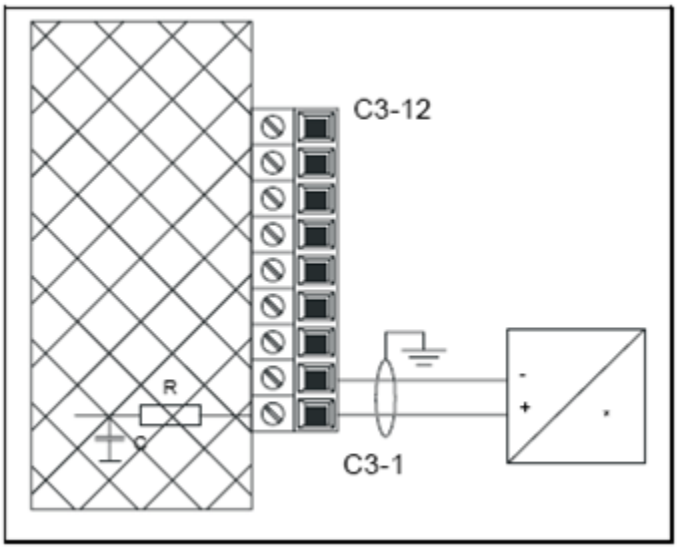
External Measured Value from Dancer / External Load Cell Source / Auxiliary input

Accepts a potentially divided input from a potentiometer in the range 0...10 Volts DC provided the potentiometer has a value no less than 1k Ohm.
A suitable supply can be obtained from the load cell excitation output. The wiring should be such that an increase in tension causes an increase in voltage.

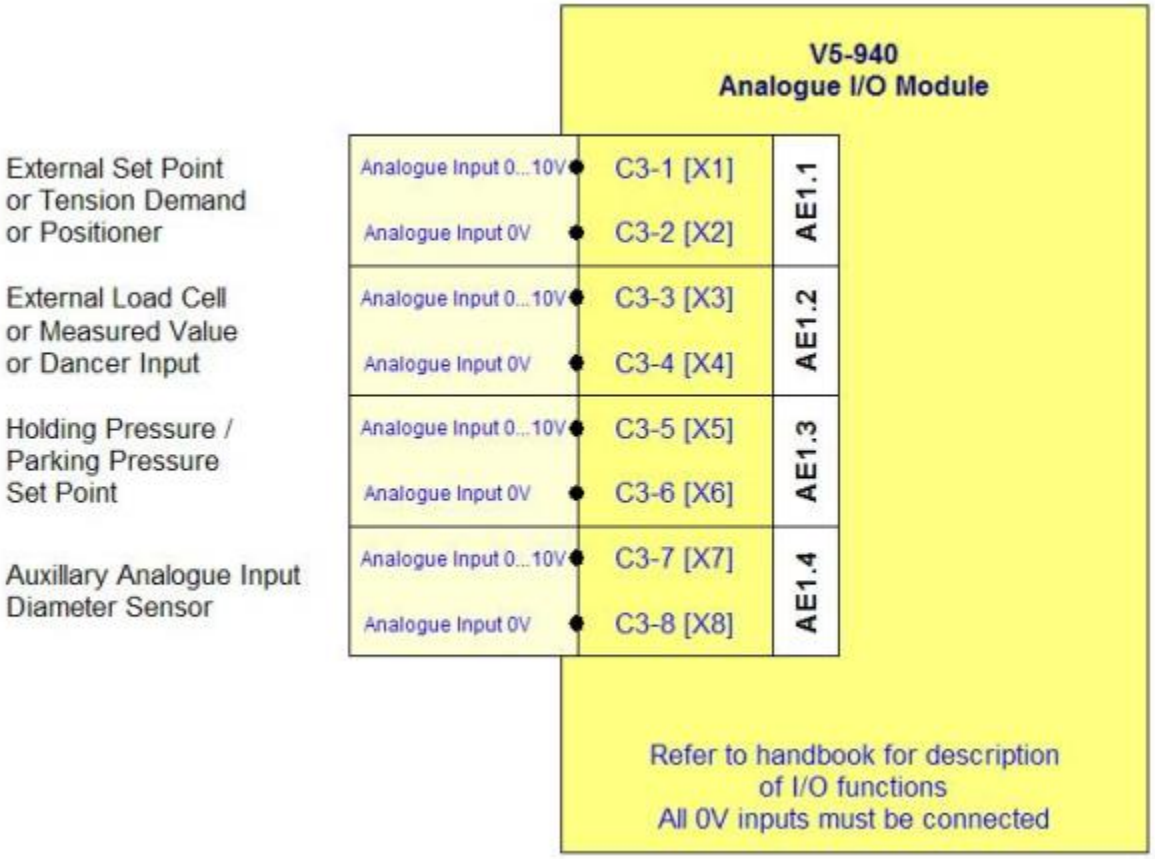
External Park / Holding Pressure

An external potentiometer provides a 0...10 Volt DC signal which is proportional to the pressure required to park the unwind reel.

Connecting Analogue Inputs



Assignment	Terminal	Function
AE1.1	C3-1(X1)	External Set point input (0..10V) *Only connect if required*
	C3-2(X2)	Return for X1
AE1.2	C3-3(X3)	Measured Value from Dancer / External Load Cell Source or Auxiliary input (0..10V) *Only connect if required*
	C3-4(X4)	return for X3
AE1.3	C3-5(X5)	External Park / Holding pressure set point (0..10V) *Only connect if required*
	C3-6(X6)	return for X5
AE1.4	C3-7(X7)	Not used
	C3-8(X8)	return for X7 Not used



- Connect the 0V of the external analogue signal source to the 0V of the analogue input concerned
- Connect the signal output of the signal source to the signal input of the analogue input. Always use two, paired terminals of the analogue input to connect a signal to the HPTC-U
- All auxiliary inputs are rated at 10 Volts DC and are high impedance and so should not load any circuits unnecessarily. It is recommended to use screened cable to limit possible interference
- If a potentiometer is required for a set point input provided it is a 1 K ohm version this could be supplied by the Load Cell excitation supply, but take care not to create any earth loops

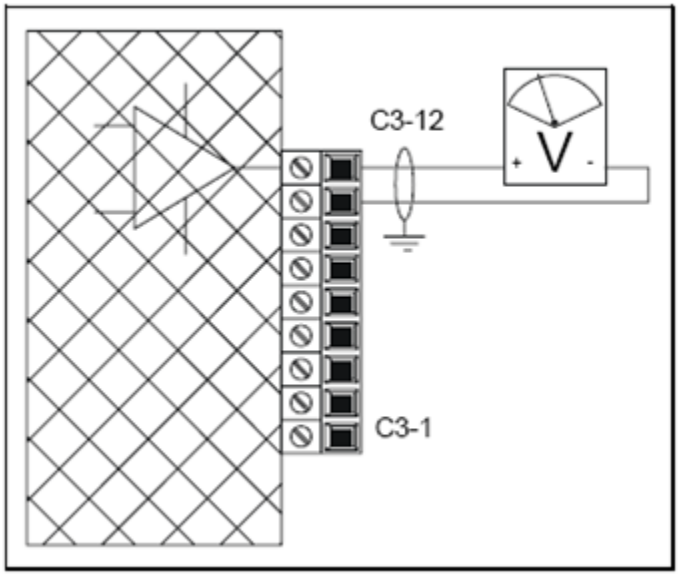
Analogue Output Functions

There are two analogue outputs provided.

- One is designated as Channel A and the second designated Channel B.
- The outputs function differently depending upon the chosen configuration.
- The analogue outputs provide 0...10 Volts DC at up to 100mA.
- These signals may be connected directly to a voltage driven actuator or voltage input on a drive.

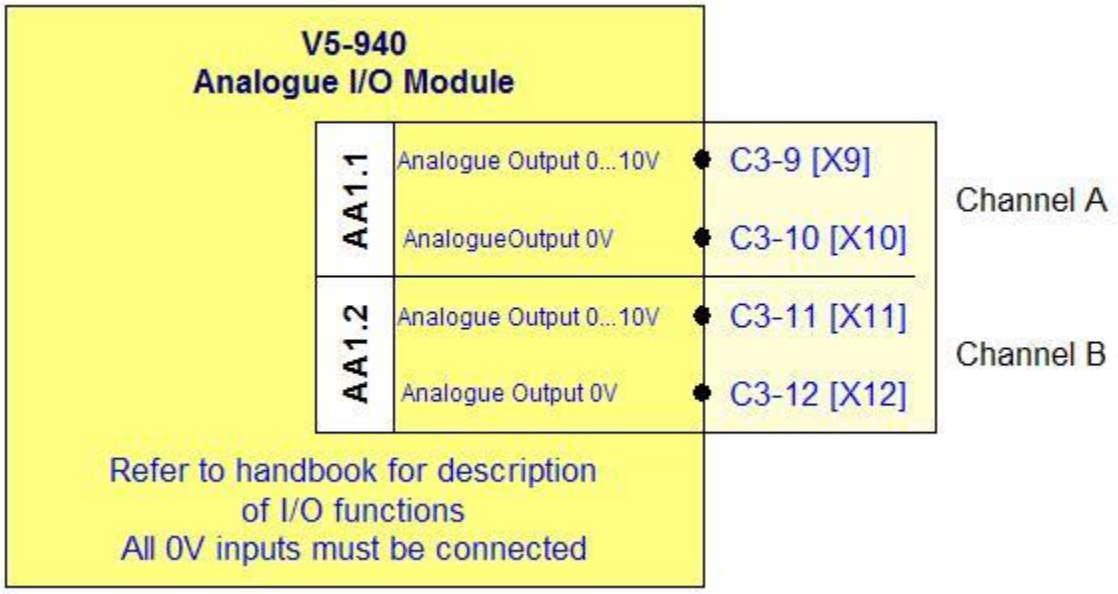
Alternatively, via a separate converter module to drive current driven actuators such as electromagnetic brakes and clutches – for example TTS CDM[x] for example will power electromagnetic brakes up to 6 Amps.

Connecting Analogue Outputs



Assignment	Terminal	Function
AA1.1	C3-9(X9)	Analogue output A
	C3-10(X10)	Return for X9
AA1.2	C3-11(X11)	Analogue output B
	C3-12(X12)	Return for X11

Analogue Output Assignments



- Connect the signal input of the load to the signal terminal of the analogue output
- Connect the 0V of an external analogue load
- The use of screened lead is advised
- These analogue outputs can supply 0...10 Volts DC at up to 20mA

Digital Input Functions

Machine Run:

When the machine run contact is open, the integrator function is in park or holding mode. When 24 Volts DC is applied to the Machine Run input the HPTC-U is in control mode. In control mode the PID integrator adjusts the analogue output to a level which maintains the tension set point programmed into the controller.

Fast Stop / Dead Stop / Web Break

For safety reasons this input must have a signal connected for the controller to work normally. The removal of this input will cause the active channel to immediately go to maximum output and hence apply maximum braking force. The inactive channel will go to the preset park pressure. Removal of this signal will cause the analogue outputs to revert to the condition prior to the signal being applied. If no fast stop / web brake input is required, it must be wired to provide a continuous signal.

When used on an unwind two channel application the active channel will be taken to maximum output for the duration the signal is missing from this input, and the inactive channel will have the normal parking pressure applied (the brake release for this channel will be operative).

Splice call

A pulse of 50mS or longer will, on the +ve edge initiate the splice sequence. See the paragraph Splice Call Logic below for a full explanation of the operation.

To perform a changeover from active channel **A** to active channel **B** or back again the tension controller must be in synchronization with external equipment, to achieve this in the simplest way the presence or absence of a signal on the channel select input should be made in order to confirm the next channel to be made active (i.e. if channel **A** is currently in control there should be no signal on the channel select input, but some time before the splice routine is initiated this input should be provided with a 24V DC signal to confirm the next channel to be made active is channel **B**, which occurs on the leading edge of the signal to the splice call input. Similarly before changing back to channel **A** the channel select input must be removed before the leading edge of the next splice call pulse).

A change from active **A** to active **B** will immediately freeze the output of **A** at the level it was at the exact point of the splice call, this is so that no sudden removal of tension causes a disturbance, at the same instant a timer will be initiated the purpose of which is to automatically inhibit the integral part of the control loop in order to prevent violent oscillations until the changeover is complete, the delay should be adjusted (within the system parameters), to the minimum acceptable. Also at the same instant the next channel to become active will be switched over to PD. control, no ramp times are included as it is important to achieve tension control as soon as possible. At the time determined by the commissioning engineer, after control is transferred the integral part of the control loop is re-enabled.

Another timer, will after a short period, reduce (or increase) the last output setting of the now inactive channel to a preset parking pressure. The sequence is now complete and operation continues as normal.

Channel select

With no signal applied channel **A** is the default.
To select channel **B** this input should receive a 24V DC signal BEFORE the splice call signal is applied and remain high until the leading edge of the splice call has occurred.

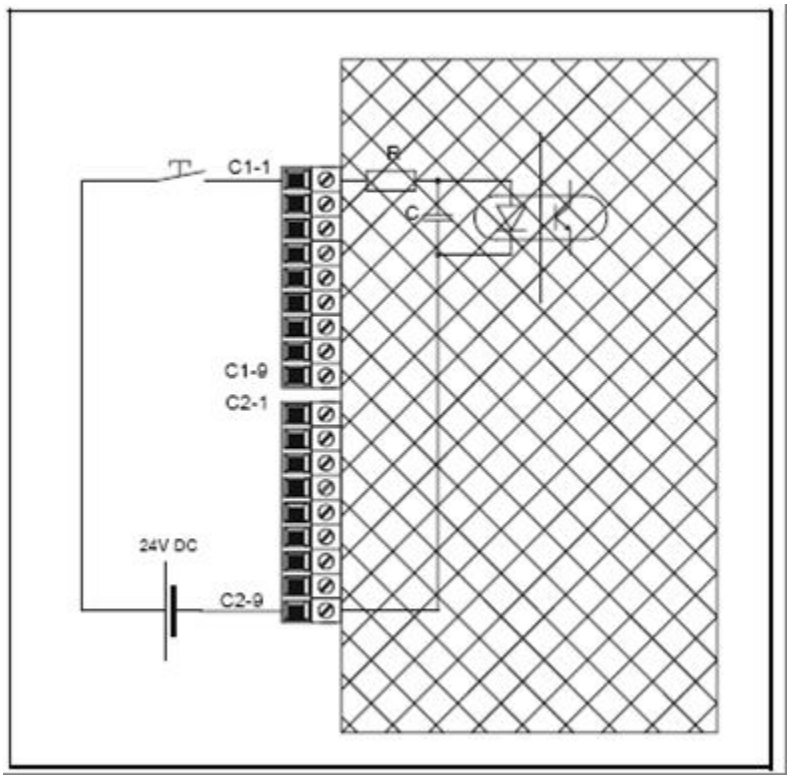
Park pressure brake A release

Part of the roll change sequence.
A 24V DC signal on this input removes the park pressure signal of analogue output **A**, but only when it is the inactive channel.

Park pressure brake B release

Performs a similar function to the signal above, but it is for channel **B** when it is inactive.

Connecting Digital Inputs



Assignment	Terminal	Function
E1.9	C2.1	Machine Run
E1.10	C2.2	Dead Stop / Emergency Stop *Must be wired or switched*
E1.11	C2.3	Fast Stop / Web Break *Must be wired or switched*
E1.12	C2.4	Splice Call
E1.13	C2.5	Channel Select (A=open)
E1.14	C2.6	Channel A release
E1.15	C2.7	Channel B release
E1.16	C2.8	Not Implemented
	C2.9	Common return

Digital Input Assignments

If isolation is not required it is possible to use the HPTC supply or the output relay supply to feed the digital inputs, in which case the 0V connections need to linked,

When connecting digital inputs you should carefully observe EMC precautions.

- Connect the 0V of an external 24 Volt DC supply with the 0V of the digital inputs
- The +24 Volt DC supply is connected to one of the digital inputs through the switch
- The current for each digital input is 6mA.
- The external signals may be switched using the +24 Volt DC supply as shown in the electrical diagrams
- The switched signal may be derived using the power supply

Digital Output Functions

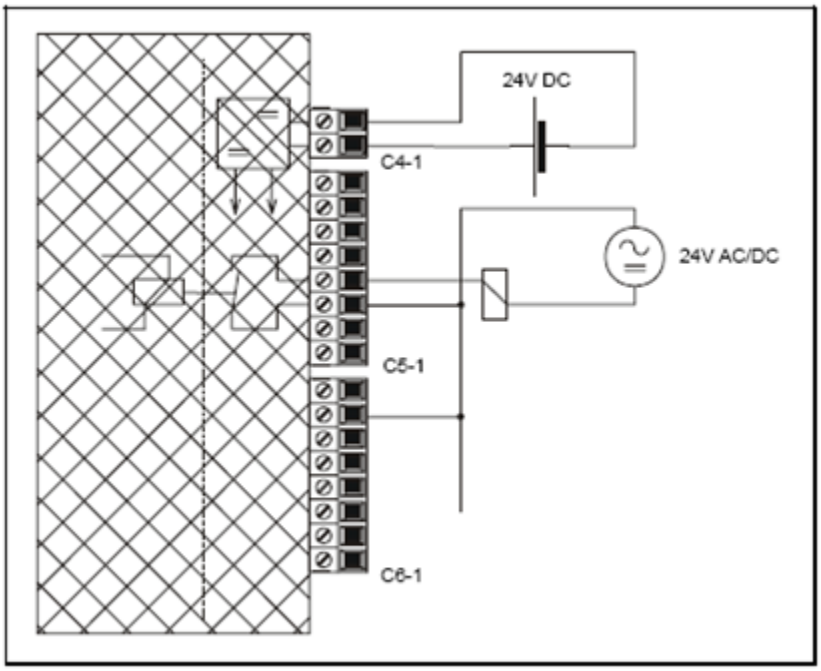
Volt Free Contacts

This feature is not currently available on current software

Using the facilities that are provided in the Material Manager program up to four outputs may be switched on or off depending upon the menu function selected.

An example of where this function may be used is where a larger brake is to be used but where less torque is required therefore pads may be switched out of circuit e.g. this may be used when working with two different grades of paper or film.

Connecting Digital Outputs



These are Volt free relay contacts, rated at 24 Volts AC / DC @ 1 amp.

The HPTC is equipped with four digital relay outputs which are available on C6 as volt free dry contacts.

To connect a digital relay output the procedure is:-

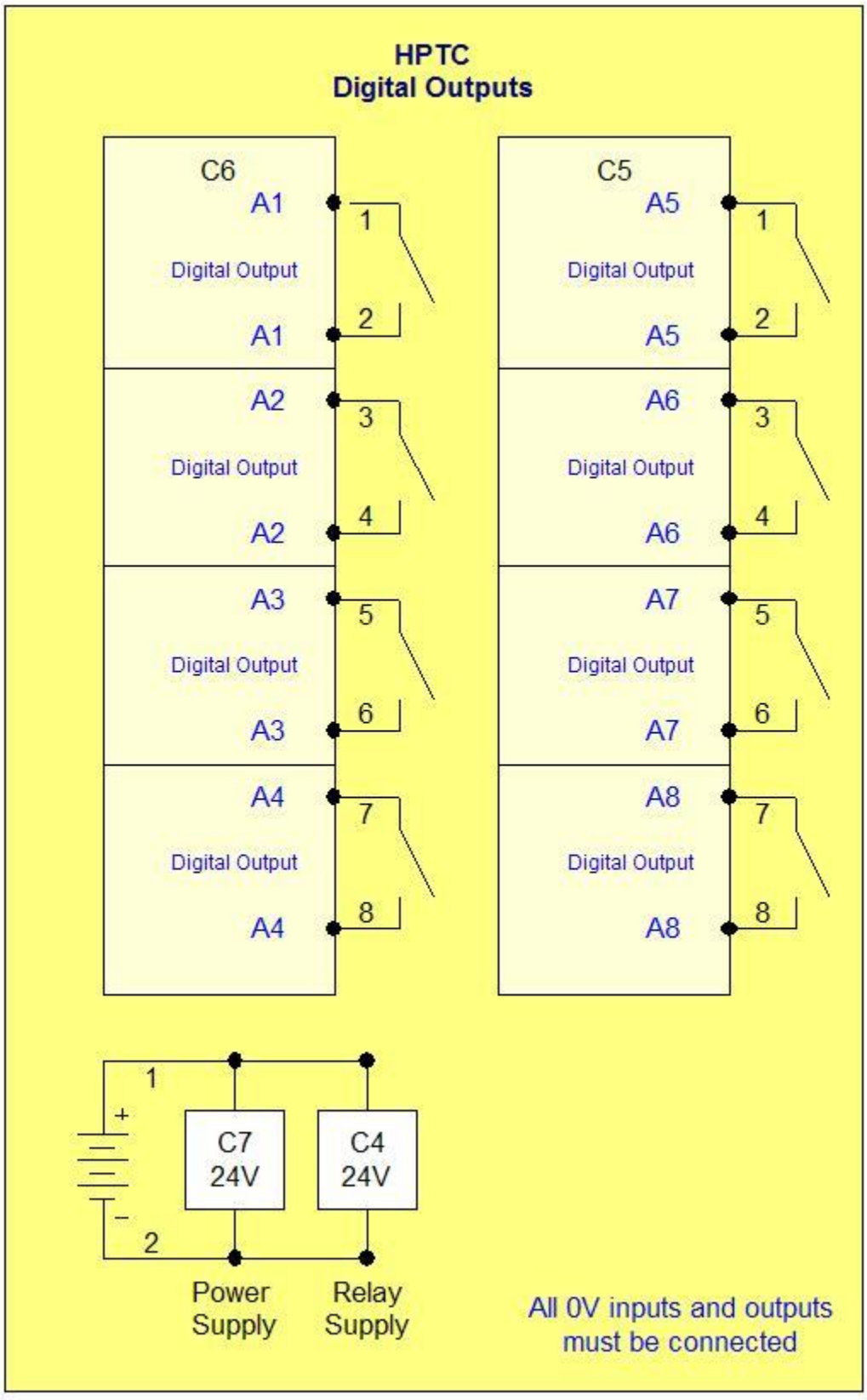
- Connect the 0V of an external 24V DC auxiliary supply with the 0V of the digital output auxiliary supply
- Connect the +24V of an external 24V DC auxiliary supply with the +24V of the digital output auxiliary supply
- Connect the load through the potential free contact of the relay output with a DC or AC source.
- These are only required if using brake pad switching on unwind stands to reduce torque requirement.

A useful trick is to feed the 24 Volt DC relay coil supply (C4), via the emergency stop circuit, thus ensuring if the emergency stop is pressed all outputs will be removed, regardless of the state of the program.

Connecting Digital Outputs

Assignment	Terminal	Function
A1.1	C6-1	Spare
	C6-2	Return
A1.2	C6-3	Spare
	C6.4	Return
A1.3	C6.5	Spare
	C6.6	Return
A1.4	C6.7	Spare
	C6.8	Return

Digital Output Assignments


HPTC
Digital Outputs
C6
A1
Digital Output
A1
A2
Digital Output
A2
A3
Digital Output
A3
A4
Digital Output
A4
C5
A5
Digital Output
A5
A6
Digital Output
A6
A7
Digital Output
A7
A8
Digital Output
A8
1
2
3
4
5
6
7
8
1
+
2
−
C7
24V
C4
24V
Power
Supply
Relay
Supply
All 0V inputs and outputs
must be connected

Load Cell / Dancer Configurations

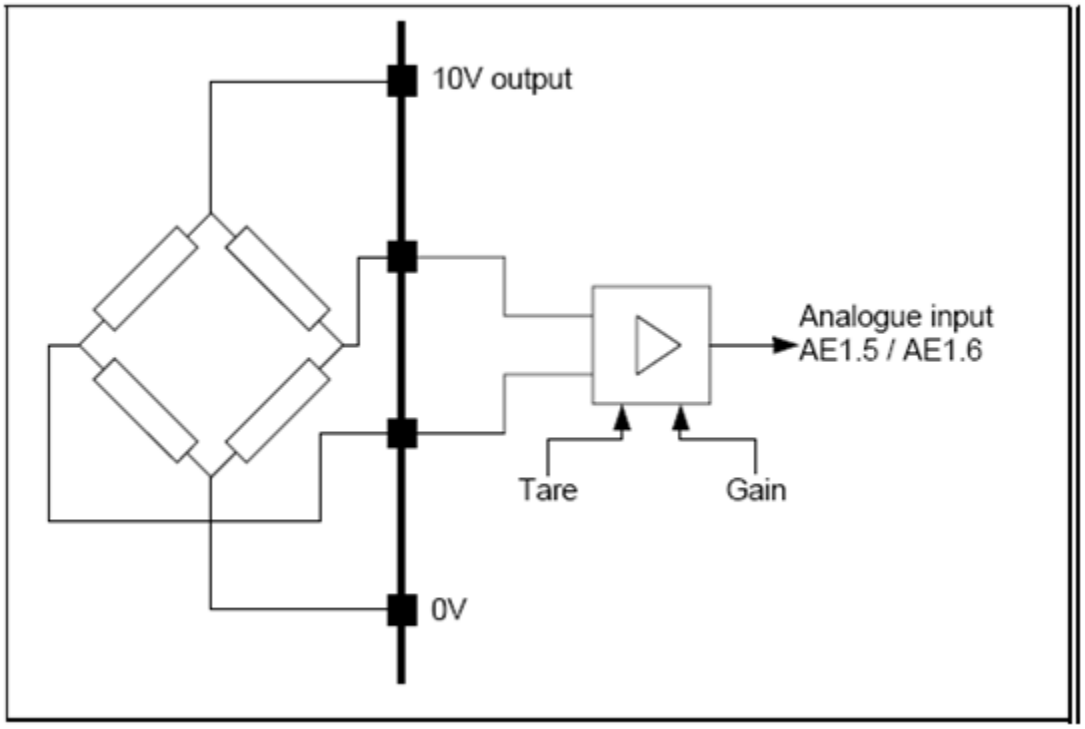
There are two methods of connecting load cell feedback to the controller.

1. The HPTC may have an integrated load cell amplifier module installed type V5-940.
   Load cells must conform to full bridge, 350 Ohm, 10 Volt Excitation.

2. The load cell feedback is supplied from an external signal conditioning amplifier is connected to an analogue input.
   The input should be a calibrated range between 0 to 10 Volts
   The voltage is connected to terminals C3-3 and C3-4
   This option is fitted to all HPTC Controllers

Connecting Load Cells to V5-940 Module

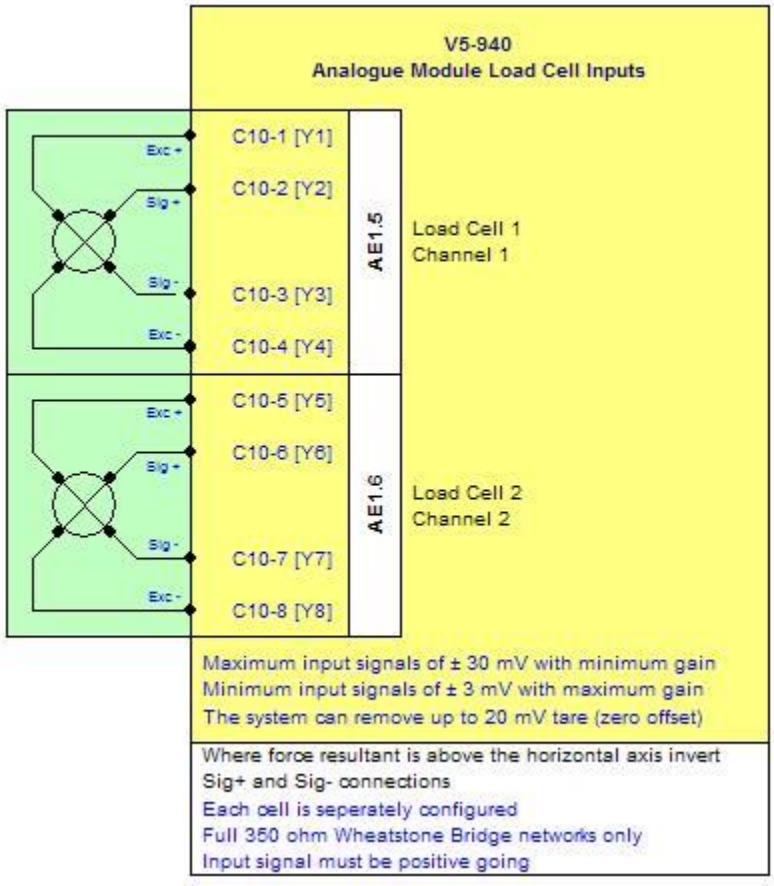
The external signals may be switched using the +24 Volt DC supply as shown in the electrical diagrams
The switched signal may be derived using the power supply



Connecting Full Bridge Load Cells

Assignment	Terminal	Function
AE1.5	C10-1(Y1)	Load Cell 1 [+Excitation supply]
	C10-2(Y2)	Load Cell 1 [Positive input]
	C10-3(Y3)	Load Cell 1 [Negative input]
	C10-4(Y4)	Load Cell 1 [-Excitation supply (0V)]
AE1.6	C10-5(Y5)	Load Cell 2 [+Excitation supply]
	C10-6(Y6)	Load Cell 2 [Positive input]
	C10-7(Y7)	Load Cell 2 [Negative input]
	C10-8(Y8)	Load Cell 2 [-Excitation supply (0V)]
	C10-9(Y9)	Reserved
	C10-10(Y10)	reserved
	C10-11(Y11)	reserved
	C10-12(Y12)	reserved

Full Bridge Load Cell Assignments



- The amplifier can measure signals of +/-30mV with minimum gain and +/-2mV with maximum gain.
- The tare adjustment can take away a tare of up to 20mV.
- The Wheatstone bridge signal conditioning amplifier creates 10 Volts internally.
- No wrap angle compensation is included as this should be considered when sizing the load cells for the application.
- It is important the full load output is a reasonably large proportion of the capability of the load cell, small ratios simply reduce the whole system accuracy
- Please refer to your load cell supplier for colour coding detail

Connecting Load Cells to Analogue V5-921 Module

To connect a load cell feedback signal please refer to Connecting Analogue Inputs Section

General Safety

HPTC's are the heart of an automation process therefore particular attention should be paid to the installation and the guidelines contained herein should be followed as closely as possible.

Only authorised and suitably qualified personnel should install, setup and commission the controller. The personnel must also be aware of the general safety regulations applying to the application

If it is found necessary to open the casing of the HPTC there is a risk of contact with high voltages therefore the entire installation should be isolated before proceeding.

Both users and installers should take precautions to ensure that after a power shutdown there is no danger of restarting the system or continuing the interrupted program.

Special attention should be given to Emergency Stop circuits, they should be designed with proper care and arranged so the HPTC cannot override the situation.

If the installation or environment could be damaged or where there is a danger of personal injury from a malfunctioning HPTC an external parallel safety circuit should be provided.

Fuses must only be replaced with the types mentioned in this manual, or if in doubt replace with an identical unit.

The earth terminal on the HPTC (C9) should always be properly bonded with the Central Earth Point (CEP) of the installation with wiring of adequate capacity and colour coding.

This manual should not be considered as definitive, where queries or contradictions occur it is important to contact the relevant bodies (supplier, Health & Safety Executive etc.), to clarify any uncertain areas.

EMC Regulations

The HPTC is designed and built in accordance with the EMC guidelines for *industrial measuring and operating equipment* as applicable in the European Union as from the 1st of January 1996, both for industrial and household applications.

To achieve conformity with the EMC regulations the equipment has been tested to the following standards. The compliance with these standards should ensure satisfactory operation in all normal environment.

As the Controller will only be one part of an installation the associated equipment and wiring should also confirm to the regulations.

EN61000-6-3	Interfering radiations (Emission)
EN50082-2	Interference radiation resistance (Immunity)
EN61000-4-2	(ESD) Immunity for static discharges.
EN50140 and ENV50204	Immunity to Electromagnetic fields
EN61000-4-4	Test for fast electrical transit burst
EN61000-4-8	Immunity to Strong magnetic fields.
ENV50141	Resistance against line related interferences generated by HF fields.

Hazardous Area Operations

In its existing form the HPTC is not suitable for operation within, or connected to equipment within a hazardous area.

If this is required, please contact our help desk and we can advise accordingly.

Contact Details

Telephone	+44 (0) 1233 624422
Fax	+44 (0) 870 705 9678
Email	support@tts-systems.com
Website	www.tts-systems.com
HPTC Section	www.tts-systems.com/products/hptc
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