Digital Process Controller
Reference Manual

Tempress® Systems, Inc.
DPC manual
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Table of contents

List of figures

1.Introduction

1.1 Scope of the manual

The Digital Process Controller (DPC) together with the Digital Temperature Controller (DTC) forms the heart of the system control. This manual is a technical description for maintenance and service engineers, of the Digital Process Controller (DPC). It contains technical information and calibration procedures of the DPC. It forms part of a series of manuals covering the full range of Amtech Tempress Systems products.

The contents of this manual and drawings are to provide the necessary instructions and information for installing, adjustment, operating, maintenance, and understanding of the Amtech/Tempress Systems Digital Process Controller.

1.2 Overview

The Digital Process Controller (DPC) has been designed for high accuracy control of all processes in diffusion and conveyor furnaces. The DPC provides a versatile means of automating all diffusion processes when used with the Digital temperature Controller (DTC).

The DPC consists of two basic units:

1. The process controller.
2. Touch screen and/or TSC-II.

In addition there is an I/O interconnection board for the connection of In- and Outputs**,** a safety board watch over the right proportion O_2 and H_2, a pressure control board and a Servo driver. The Program and Display unit, Touchscreen or TSC-II, are used to program the recipe commands. The Touch Screens can be mounted in the control panel area. TSC-II is free to locate.

The DPC is a microprocessor-based controller, which can perform all process functions for the selection of temperature recipe on the DTC, including control of boatloader and gas flow as well as the sequencing of overall processing. The DPC interfaces directly with the DTC, which is a highly accurate microprocessor-based controller of temperatures in diffusion and conveyor furnaces.

1.3 System Features

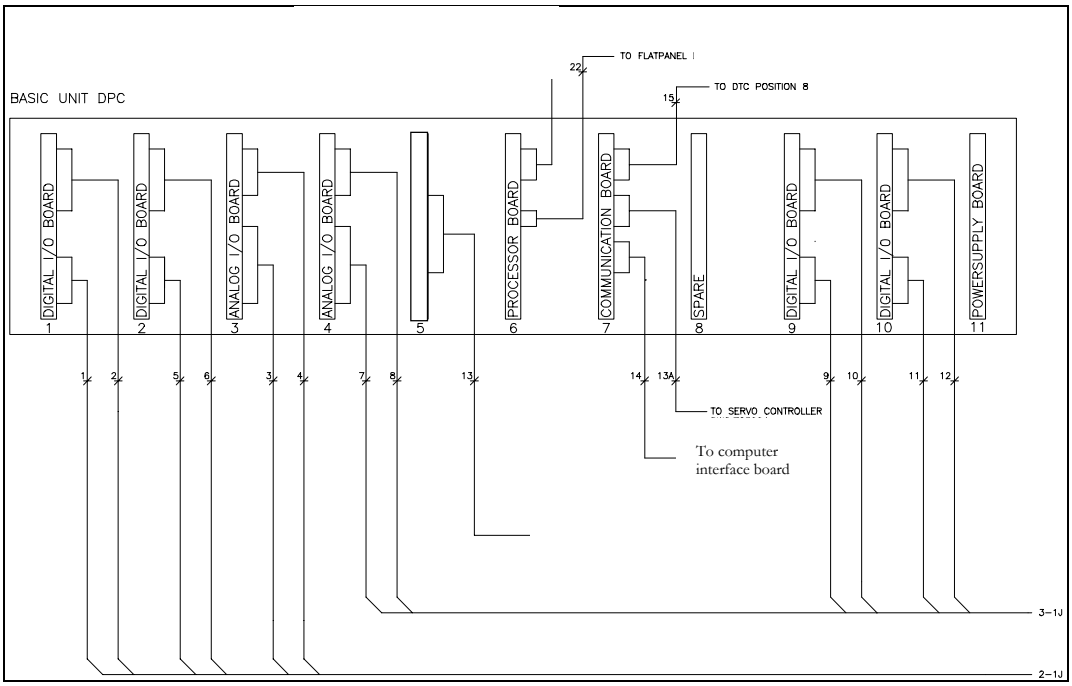


Figure 1-1 DPC System overview

RECIPES: A maximum of 16 normal recipes up to 750 bytes long or 8 recipes 1500 bytes long and 8 abort recipes can be contained. The length of an abort recipe is 200 bytes maximal.

DISPLAY OF MESSAGES: A maximum of 16 messages, each of up to 12 characters long can be displayed

BOAT LOADING CONTROL: Auto position calibration. Inputs are monitored with alarm for left and right limit and boat fused.

TEMPERATURE CONTROL: Temperature Control is by connection to the DTC through an RS422C serial interface. Up to 16 temperature recipes can be selected. Each temperature recipe includes: temperature, ramping, type of control (paddle or spike), and independent or Master/Slave and alarm limit settings. Up to 16 profile recipes can be selected for automatic profiling.

ANALOG OUTPUTS: There are 8 analog outputs (optionally 16), which allow programming of outputs in a variety of units and ranges, each with a setpoint resolution of 1 digit.

DIGITAL OUTP UTS: There are 8 digital outputs (optionally 16, 24 or 32). It is possible to interlock the digital outputs with analog outputs for soft start on Mass Flow Controllers.

DIGITAL INPUT: The system will accept digital inputs for process monitoring. The process monitoring includes provisions for pressure switches, door switches, etc.

"WAIT FOR" PROVISION: The system contains a "wait for" provision until condition is satisfied for start, time, temperature, boat, digital inputs, digital outputs, analog I/O on setpoint and pressure.

DTC INTERFACE: A 6850 Asynchronous Communications Interface Adapter (ACIA) is used for the RS422C compatible serial interface to the DTC. Baud rate is 9600 bits/s.

BATTERY BACK-UP: An external Ni-Mh battery maintains data stored in volatile memory for a minimum of 30 days after power is disconnected.

1.4 Technical description

Time

Resolution time	:second.
Maximum time per step number	:255 hours, 59 minutes, 59 seconds.

Boat loading Control

Speed range	:5-1000 mm/min.
Speed resolution	:1 mm/min.
Position range	:10-3000 mm.
Position resolution	:1 mm.
Oscillation speed (only in combination with the soft contact loader).	25 mm

Auto zero position calibration.
Monitoring inputs with alarm for left and right limit and boat used.

Analog Outputs

No. of outputs	:8 (optionally 16).
Range	:0-5V.

Programming and monitoring may be in the following units and ranges:

Units	:percent, SCCM, SLM, °C, TORR, MTOR and mg/m, plus free programmable (max 8 char)
Ranges	:0-300, 0-500. 0-800, 0-1000, 0-1200, 0-1500, 0-1800 and 0-2000, and free programmable. Point position programmable.
Setpoint resolution	:1 digit.

Analog Inputs

No. of inputs	:8 (optionally 16) for monitoring analog outputs with provision for alarms, wait for, branch on, and abort on. 8 (optionally 16) for process monitoring.

Digital Outputs

Number of outputs	:8 (optionally 16,24 or 32).
Specification	:opto-isolated Darlington transistor outputs max 1A, 30V.

Interlock possibility with analog outputs for soft start on Mass Flow Controllers. If a digital output is interlocked, the valve automatically opens if the setpoint for the analog output is programmed.

Digital Inputs

Number of Inputs	:8 (optionally 16,24 or 32) opto-isolated inputs for monitoring, digital outputs with alarm provision. 8 (optionally 16, 24 or 32) opto-isolated inputs for process monitoring with alarm, wait for, branch on and abort on provision.
Input voltage	:5-30V.

Step Number

Each step number can have any of the following commands: message, time, temperature recipe, boat, analog outputs, digital outputs, alarm, branch, abort, wait for and abort recipe. A Variable Command can be set in combination with several of the commands mentioned above to allow quick adjustments of those commands.

Messages

Number of messages:	:16.
Message Length:	:12 characters.

Recipes

Number of normal recipes	:8 or 16.
Normal recipe length	:1500 or 750 bytes.
Number of abort recipes	:8.
Abort recipe length	:200 bytes.

Temperature Control

RS422C serial interface to the Digital Temperature Controller. Up to 15 preset temperature recipes may be selected, one is freely programmable. Each temperature recipe includes temperature, ramping, type of control (paddle or spike), independent or Master/Slave and Alarm Limit settings. Up to 16 profile recipes may be selected for automatic temperature profiling. "Wait for" provision for end of ramping, end of profiling and within temperature alarm limits.

Other Technical Data

Operating voltage	:115/220/240V 50/60 Hz.
Ambient temperature	:0 - 40 ^{o} C.
Serial interface to remote computer	:RS422C compatible, baud rate 9600 bits/s.
Dimension	:125 x 290 x 310 mm.
Battery backup	:minimum 30 days memory retention time.

2.Technical Description

2.1 Introduction

The basic Digital Process Controller (DPC) consists of a base unit with a motherboard for the plug-in boards, a main transformer, a battery board and a rear connector. The standard unit includes the power supply board, the processor board, one digital I/O board, one analog I/O board and the RS422 communication board. Four additional slots in the unit permit the expansion of both the analog and digital capabilities. A pressure interface board for low-pressure purposes and a safety board for hardware controlling the ratio of a H_2 and O_2 mixture can be added to the process control loop. The pressure interface board and the safety board are tied to the analog and digital interconnection boards.

2.2 Digital I/O Board

Each digital I/O board has 8 optically isolated digital outputs and 8 optically isolated digital inputs. Each of the outputs has a Darlington transistor with a maximum current of 0.5 amp at 30 volts DC. This will drive most gas solenoids, relays or lights without additional current drivers or relays.

Each output has an optically isolated input for checking the output condition in the "off' state. If the output supply voltage is missing, the alarm will sound and the display will show the digital output alarm. To ignore the alarm for these outputs, unused outputs must be tied to +24V via a 2K7 resistor.

The 8 digital inputs will be on when a voltage of between 5 and 30 volts is applied to it. Each digital input may be used for process monitoring with “alarm”, “wait for", "abort on” and "branch on" (only on inputs 1-16) provision.

2.3 Analog I/O Board

Each analog I/O board has 8 analog outputs and 16 analog inputs with a range of 0-5V. The 12 bit digital-to-analog converter (DAC 800) is used in the range -5V to +5V. A negative output voltage is used only for a soft start on normally open Mass Flow controllers and is not programmable. Eight of the analog inputs are used in combination with the analog outputs. The analog output supplies the setpoint for a mass flow controller and the corresponding analog input is used for monitoring the actual flow. All these combinations have, “Limit Alarm”, “wait for", “branch on” and “abort on" provisions. The other 8 inputs may be used for process monitoring.

2.4 Processor Board

The hub of the system is a Motorola CMOS, 8-bit microprocessor. The on-board timer is used for all the timing functions.

There are two connectors. One is a 10-pole flat cable connector, which is used to connect to the 'Program and Display Panel' unit. This is RS232C compatible. The other connector is a 6-pole flat cable connector, which is used for connecting the Touchscreen Display. This is RS422 compatible. Both connectors share the same signal lines and can therefore not be used simultaneously.

The board is provided with an automatic restart circuit. If the microprocessor stops for more than 5 seconds, the power supply supervisor will reset the system.

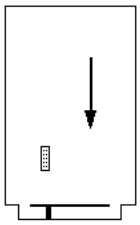
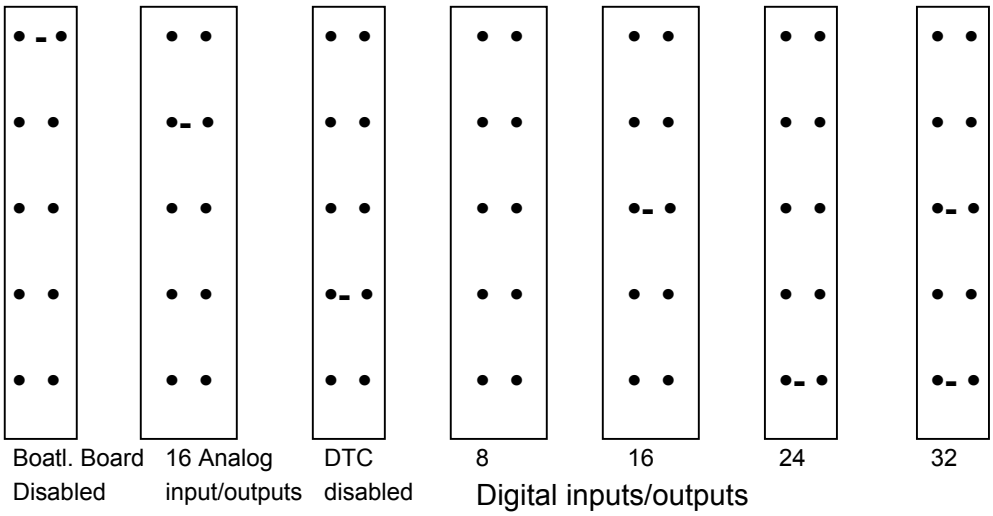


Figure 2-1 Jumper position on process at board

This board also contains jumper connections, which provide the following functions:



2.5 Communication Board

The communication board is a 3-channel communication board. This board provides the communication with the digital temperature controller (DTC), to the servo control unit (loader) and the Tempress system controller (TSC). The communication link with the DTC is a RS422 current one with a baudrate of 9600 baud. The links for the TSC and for a vertical loadsystem are also RS422 current ones. The baudrate is preselected on 9600 baud.

The board contains 10 pole connectors for connections to the TSC and DTC and if used also for the vertical boatloading system. An ACIA (6850) performs the parallel to serial conversion.

2.6 Powersupply Board

The Powersupply board takes care for the voltage for the all DPC boards. The Powersupply board supplies +12/-12V as well as +15/-15V.

2.7 I/O Interconnection Board

The digital inputs and outputs are connected to the digital interconnection board and the analog inputs and outputs are connected to the analog interconnection board. These interconnections boards interface between the DPC and the actual valves and MFC's and also allow for additional safety boards.

Two additional flat cable connectors are provided for connecting a gas flow panel with lights (not used when a Touchscreen Display is used) and a ratio and temperature safety board.

An on board safety circuit switches off the +24V to the digital outputs in case the DPC ceases to trigger the circuit. This results in switching of the (dangerous) gases by closing the valves.

2.8 Pressure interface board

The pressure interface board will be used in Low Pressure Chemical Vapour Deposition (LPCVD) systems. On board is a stabilized power supply of + and - 15V for an externally connected pressure transducer and the electronic circuits. A +12V supply, supplies the digital circuit. The external transducer creates a voltage of 0-10V corresponding to the pressure of 0-10 TORR. This voltage is applied to the operational amplifier, which gives the output of 0-5V corresponding to 0-2000 mTORR, or 0-10 TORR, which is selectable on the board by a wire-jumper

The output of this amplifier is connected to a comparator, which compares it with an adjustable setpoint. It is the safety circuit, which insures that the solenoid valves can not be activated if the pressure is above the setpoint value.

An evacuate line control circuit is on board to evacuate up to 6 gas lines in a safe manner. A maximum of 6 lines can be controlled and only one valve can be open at the any time.

2.9 Safety board

The safety board is used to check the safety conditions when using hydrogen and oxygen in a Tempress external torch. It is used as a hardware protection. This safety board works only in combination with the Tempress DPC control system. It is not used in this configuration as a "stand-alone" unit.

The safety conditions are:

- Torch temperature above setpoint value
- Correct H_2/O_2 Ratio
- Torch flame present

When the Hydrogen MFC is activated the safety board checks whether the injector tip temperature and the gas ratio are safe. Only then the hydrogen valve will be opened and hydrogen is allowed to flow.. After20 seconds the presence of the hydrogen flame is checked for. If no flame is detected the hydrogen valve is deactivated and the hydrogen flow stops. If a ratio alarm or flame detection alarm occurs, the hydrogen valve will be closed and the condition, which caused the alarm, is latched until, in a next run, the hydrogen valve opens again. LED's shows the latched conditions. These conditions are also available for connection to the digital inputs of the Digital Process Controller. When the hydrogen valve was switched off by an alarm condition, it is only possible to open it again via de-activating the hydrogen input and activate it again (in a process recipe in the Digital Process Controller). (For more information see the External Torch Instruction and maintenance Manual).

2.10 Temperature control

An RS422 compatible serial interface connects the DPC to the Digital Temperature Controller. The baud rate is 9600 bits/s. The DPC can select up to 16 temperature recipes and 16 profile recipes for automatic temperature profiling. The DPC has a "wait for" provision for end of ramping or end of automatic profiling. All the alarms of the DTC are sent to the DPC, where the alarm will sound and the display will show temperature alarm. The DPC has a "wait for", "branch on" or "abort on" provision on this temperature alarm.

3.Recipe commands

3.1 Introduction

The standard recipe commands as programmed in the DPC can be used to make a process recipe. This chapter contains a description of all possible commands.

3.2 Recipes

The unit can store and execute 8 or 16 normal recipes and 8 abort recipes. A recipe consists of step numbers and commands. Each step number may have the following commands:

Message	Alarm
Time	Branch
Temperature recipe	Abort
Boat	Wait for
Analog output	Abort recipe
Digital Output	Variable Command

Step number 0 of a normal process recipe is used for standby conditions if possible.

After starting the process recipe, the step numbers are executed sequentially. The sequence can be interrupted by active branch or abort conditions. An automatic or operator initiated abort causes the programmed abort recipe to be executed like a normal recipe if it is activated. At the end of the abort recipe the system returns to step number 0 of the aborted recipe.

If no abort recipe is activated any automatic or operator initiated abort causes the DPC to return to step 0 of the aborted process recipe immediately.

3.2.1 The message command

The message command will be displayed throughout the execution of the step. The messages that can be used are defined during the certification procedure.

3.2.2 The time command

The time command is used to program the time to wait before executing the next step number. If there is a WAIT command in the step the time is used for the wait alarm. In this case the next step will begin as soon as all the wait conditions have been satisfied. If the wait conditions are not satisfied by the end of the entered time, the alarm will sound and the wait alarm condition will be shown.

To calculate a realistic total process time, the time needed to satisfy all the wait conditions should be used. The remaining time in the process is recalculated at the start of each step, so the remaining time is connected after each wait condition.

3.2.3 The temperature command

The "TEMP" command instructs the DTC to execute the indicated normal temperature recipe or profiling temperature recipe. Up to 16 normal process temperature recipes or profile temperature recipes area available from the normal temperature table or profiling temperature table.

3.2.3.1 Temperature normal recipe

The normal temperature recipe is used to define the actual process temperature needed for the process. Up to 15 preset normal temperature recipes can be stored in the normal temperature table including temperature setpoint, ramp rate, high/low limits, gain, control type and which profiling temperature table to use. The last position (recipe 15) in the normal temperature table is free programmable and allows for unlimited process temperatures.

3.2.3.2 Temperature profile recipe

To improve temperature accuracy automatic or manual profiling can be used. Up to 16 profiling temperature recipes can be stored in the profiling temperature table. Each profiling temperature recipe contains the paddle thermocouple setpoint, the corresponding spike thermocouple values and the required power output. Four different profiling temperatures tables (A, B, C, D) are available to accommodate different process environments. Ramp all zones to setpoint temperature.

The free programmable normal temperature recipe (#15) will be overwritten by the "Ramp all zones to setpoint temperature" command. Set High/Low limit for all zones. The free programmable normal temperature recipe (#15) will be overwritten by the "Set High/Low limits for all zones" command.

3.2.3.3 Set High/Low limit for one zone

Same as 3.2.3.2, only now it is possible to define one particular zone (1-5).

3.2.3.4 Set gain for all zones

The gain is an amplification factor for the PID control. Default value is 100%, maximum value 255%. The free programmable normal temperature recipe (#15) will be overwritten by the "Set gain for all zones" command.

3.2.3.5 Set gain for one zone

Same as 3.2.3.4, only now it is possible to define one particular zone (1-5).

3.2.3.6 Set temperature control

The PID temperature control loop needs thermocouple signals as input. The "Set temperature control" command define which thermocouple should be used. In addition, the master-slave or independent control must be selected here (default independent).

3.2.3.7 Select profile table

This function is to select one of the four (A-D) profile temperature tables.

3.2.4 The boat command

The boat command will program the boat position, the boat speed and the oscillation speed. The boat loader moves to the position indicated at the programmed speed. Normally the oscillation field is 0, the boat stops when it reaches the position. In case the system requires a Soft Contact Loader, the oscillation speed will be used to define the vertical movement of the paddle.

3.2.5 The analog output command

The analog output command is used to set the output voltage of the indicated analog output corresponding to the setpoint value in the range of 0-5V, and the digital output of corresponding number if an interlock was programmed. The range and units of the analog output and the interlocks are defined during the certification procedure. The analog outputs will be commonly used to manage mass-flow controllers and bubbler temperatures.

3.2.5.1 Set ramp time all analog outputs

The ramp time for all analog outputs defines the time that is allowed to reach the specified setpoint. Default value is 8 sec, maximum value is 255 sec.

3.2.5.2 Set ramp time one analog output

Same as 3.2.5.1, only now for 1 particular analog output.

3.2.6 The digital output command

The digital output command is used to put the digital outputs into the ON or OFF condition. During the certification procedure a digital output can be interlocked to an analog output. This output cannot be programmed with a digital output command, but will be activated automatically if the setpoint of the matching analog output is > 0. Most commonly a digital output will manage a gas valve.

3.2.7 The alarm command

3.2.7.1 Alarm on Digital Inputs:

The alarm command on the digital inputs is used to make active or non-active a detected alarm condition for each of the digital inputs. The input voltage on a digital input may be between 5 and 24V for a non-alarm condition. An open input (< 5V) is an alarm condition.

3.2.7.2 Limit Alarm On Analog I/O Combinations:

The analog limit command will set the alarm limits to plus and minus the indicated setting in percentage of maximum scale of the analog I/O combination.

3.2.8 The branch command

A branch command in a step may be used to branch on a specified condition to another step in the recipe. The branch condition is checked at any time during the step. In steps with more than one branch command, they will be checked in the sequence of programming.

A branch is taken to the indicated step number 3 seconds after the branch condition is set and still active. The branch command has a sonalert alarm provision.

The step number and the time remaining in the step are stored at the moment the branch is taken. This is important to retrieve branch data for review.

3.2.8.1 Branch Always:

In this case a branch is always taken and creates an infinite loop. Therefore it should be used with great care. It is not possible to load time, message, abort or wait commands. All the other commands should be used to set the parameters prior to taking the branch.

3.2.8.2 Branch on a Digital Input:

A branch is taken at any time during the step when the selected input is in the zero (open) condition for more than 3 seconds.

3.2.8.3 Branch on an Analog Out of Limit:

A branch is taken at any time during the step when the selected analog I/O combination is in the out of limit condition for more than 3 seconds.

3.2.8.4 Branch on Temperature Alarm:

A branch is taken at any time during the step when the DTC is in the alarm condition for more than 3 seconds.

3.2.8.5 Branch on Boat Alarm:

A branch is taken at any time during the step when the boat loader is in the alarm condition for more than 3 seconds.

3.2.8.6 Branch on Wait Alarm:

A branch is taken at the end of the step when there is a wait alarm condition for more than 3 seconds.

3.2.8.7 Branch on Alarm:

A branch is taken at any time during the step when there is an alarm condition for more than 3 seconds.

3.2.8.8 Branch Sub:

A maximum of 10 nested subroutines can be started using the BRANCH SUB command. The step number at which the subroutine starts is programmable and is an argument to the command.

3.2.8.9 Branch Return:

Using the BRANCH RETURN command signifies the end of a subroutine. This returns the process to the step after the step from which the subroutine was started.

3.2.8.10 Branch Loop:

A maximum of 10 nested program loops can be programmed using the BRANCH LOOP command. The number of times to loop and the step number where the loop begins are arguments to the command.

3.2.9 The abort commands

The abort commands are used to abort on a certain condition. The abort condition can be checked at any time during a step and must be active for at least 30 seconds before the abort is taken. The alarm will sound and the abort condition will be shown.

The step number and the time remaining in the step are stored at the moment the abort is taken. This is important to retrieve abort data for review.

3.2.9.1 Abort on Digital Inputs:

An abort is activated when one of the selected inputs is in the alarm condition for 30 seconds.

3.2.9.2 Abort on Analog Limit Alarm:

An abort is activated when one of the selected analog I/O combinations is in the condition for 30 seconds.

3.2.9.3 Abort on Temp:

An abort is activated when the DTC is in the alarm condition for 30 seconds.

3.2.9.4 Abort on Boat:

An abort is activated when the boat loader is in the alarm condition for 30 seconds.

3.2.9.5 Abort on Wait:

An abort is activated when there is a wait alarm condition for 30 seconds.

3.2.9.6 Abort on Alarm:

An abort is activated when there is an alarm condition for 30 seconds.

3.2.10 The wait command

The wait command instructs the DPC to wait for the specified wait conditions are until they are satisfied. There may be several wait commands in one step. If the wait conditions have not been satisfied before the time set by the TIME command has elapsed, the alarm will sound and the wait alarm condition will be shown.

3.2.10.1 Wait for Ready:

The "Wait for ready" command is a general command and can be used to check all setpoints and alarm conditions. The condition is satisfied when the boat, temperature and analog I/O combinations have reached their setpoints and there is no alarm condition. When a profile temperature recipe is selected, the condition is satisfied by the end of automatic profiling.

3.2.10.2 Wait for Operator:

The "Wait for Operator" condition is used to stop the process for operator action. It is satisfied when the operator restarts the process.

3.2.10.3 Wait for Digital Inputs:

The "Wait digital inputs" condition is satisfied when all the digital inputs match the programmed format. If the time has not elapsed the alarm on the selected inputs is ignored.

3.2.10.4 Wait for Temperature:

There are two wait temperature conditions that can be set:

a) Wait for Temp Setpoint.

The condition is satisfied when the temperatures in all the temperature control zones are at setpoint within the alarm limits, for a profile temperature recipe at the end of auto profiling.

b) Wait for Temp zone 1, zone 2, zone 3(zone 4, zone 5 or zone 6).

The condition is satisfied when the paddle temperature has reached the specified temperature for the selected control zone.

3.2.10.5 Wait for Boat:

There are two wait boat conditions that can be set:

a) Wait for Boat Setpoint.

This condition is satisfied when the boat has reached the setpoint and is stationary.

b) Wait for Boat Pxxxx.

This condition is satisfied when the boat has reached the specified position.

3.2.10.6 Wait on Analog I/O Combination:

The wait analog I/O combination is satisfied when the indicated input/output combination has achieved the setpoint within the alarm limits.

3.2.11 The abort recipe command

The abort recipe command sets the abort recipe number to be executed if either an automatic or operator originated abort situation occurs. The abort recipe number remains in force until another abort recipe command is used to change the recipe number. If no abort recipe command is used the DPC will return to step 0 of the process recipe on abort.

3.3 The variable command

A variable command may be of use during process development. With this command it is possible to quickly change the programmed values of time, analog I/O, digital output, temperature and boat, before starting the recipe without the use of the recipe editor. These programmed values are held during the recipe.

4.Calibration

4.1 Introduction

To calibrate the analog input/output board a power supply with a resolution of 1 mV is needed. There are 11 potentiometer adjustments on the board, 3 of them are used for the zero and gain adjustment of the 12-bit converter and the other 8 are used for the offset adjustment of each analog output.

4.2 Procedure

4.2.1 Zero and Gain Adjustment

Use one of the analog inputs on I/O interconnection board, for example Analog input 1, for these adjustments. Use the certification procedure to program a range of 0-2000 for this input. The calibration procedure is as follows:

1) Connect T1 to T2 (see figure 2)

2) Put the Touchscreen or TSC-2 in Monitor Status, and select the analog input/output combinations.

3) Adjust P9 until the reading switches from the minimum to the maximum.

4) Remove the connection between T1 and T2 and connect Analog Input 1 to ground.

5) Turn P11 until the reading is non zero. Turn P11 slowly in the opposite direction until the reading is zero.

6) Remove the short to ground on Analog Input 1 and apply a voltage of 4.950V. The reading on the display should be 1980 units. If the reading is above 1980 decrease P11 by twice the difference. If the reading is below 1980 increase it in the same manner.

   For Example:

   If the reading is 1990, decrease it to 1970.

   If the reading is 1975, increase it to 1985.

7) Short Analog lnput to ground again and adjust P11 until the reading is zero.

8) Remove the short and re-apply the 4.950V. Repeat steps 6 and 7 until the reading is 1980 when the voltage is applied.

4.2.2 Offset Adjustments Analog Outputs

1) Connect the analog inputs to the corresponding analog outputs. This can be done by placing a jumper on the A1 - A8 (pin 8-9) connectors on the I/O interconnection board. I/O 1 = x7; I/O 8 = x 14.

2) Put the Touchscreen or TSC-II display in Monitor Status and select the Analog Input/Output combinations.

3) Adjust each potentiometer, which corresponds to the input number until the actual value is equal to the setpoint value.

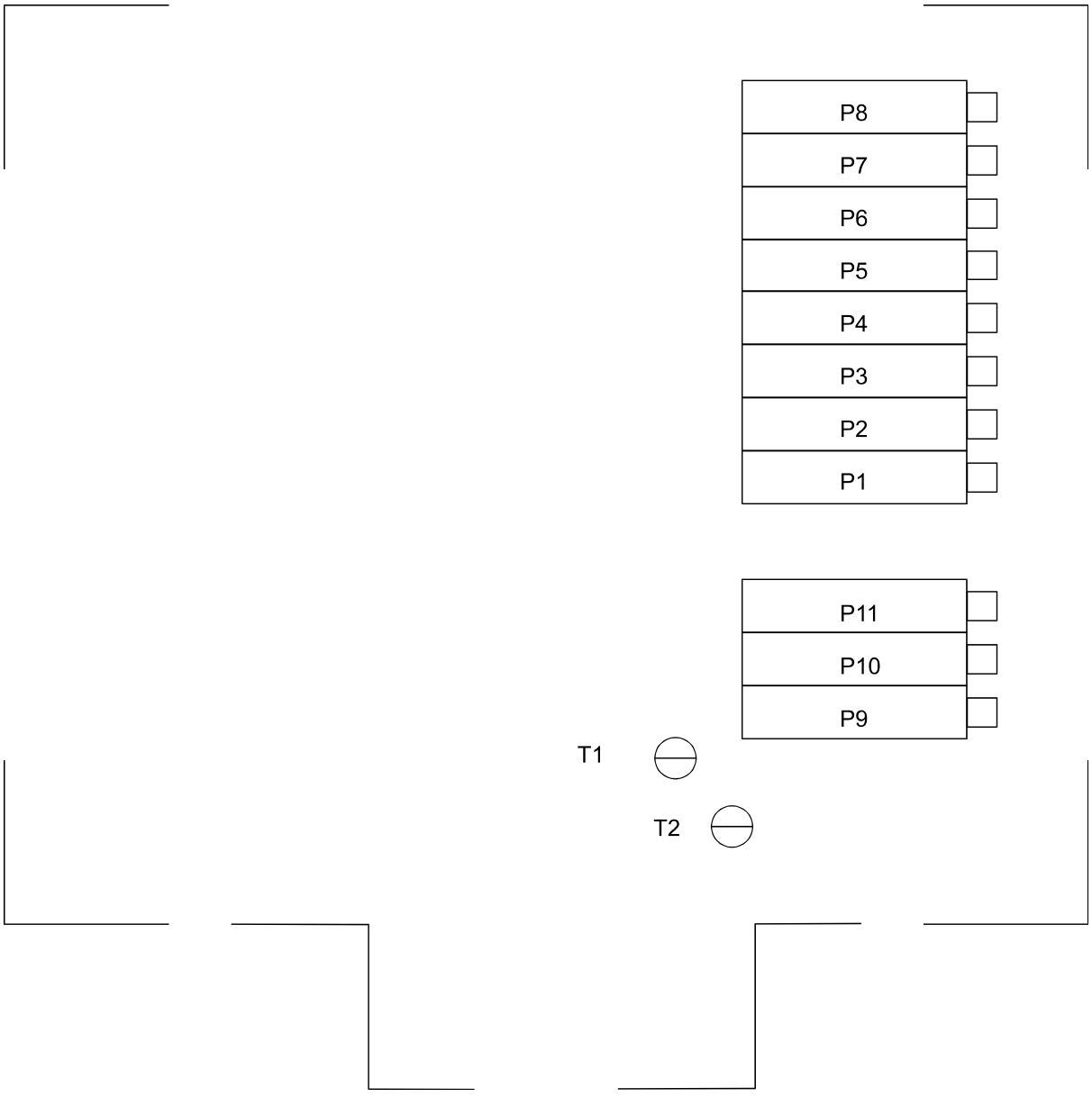


Figure 4-1 Analog Input/Output Board

5.Connector Function and Calibration

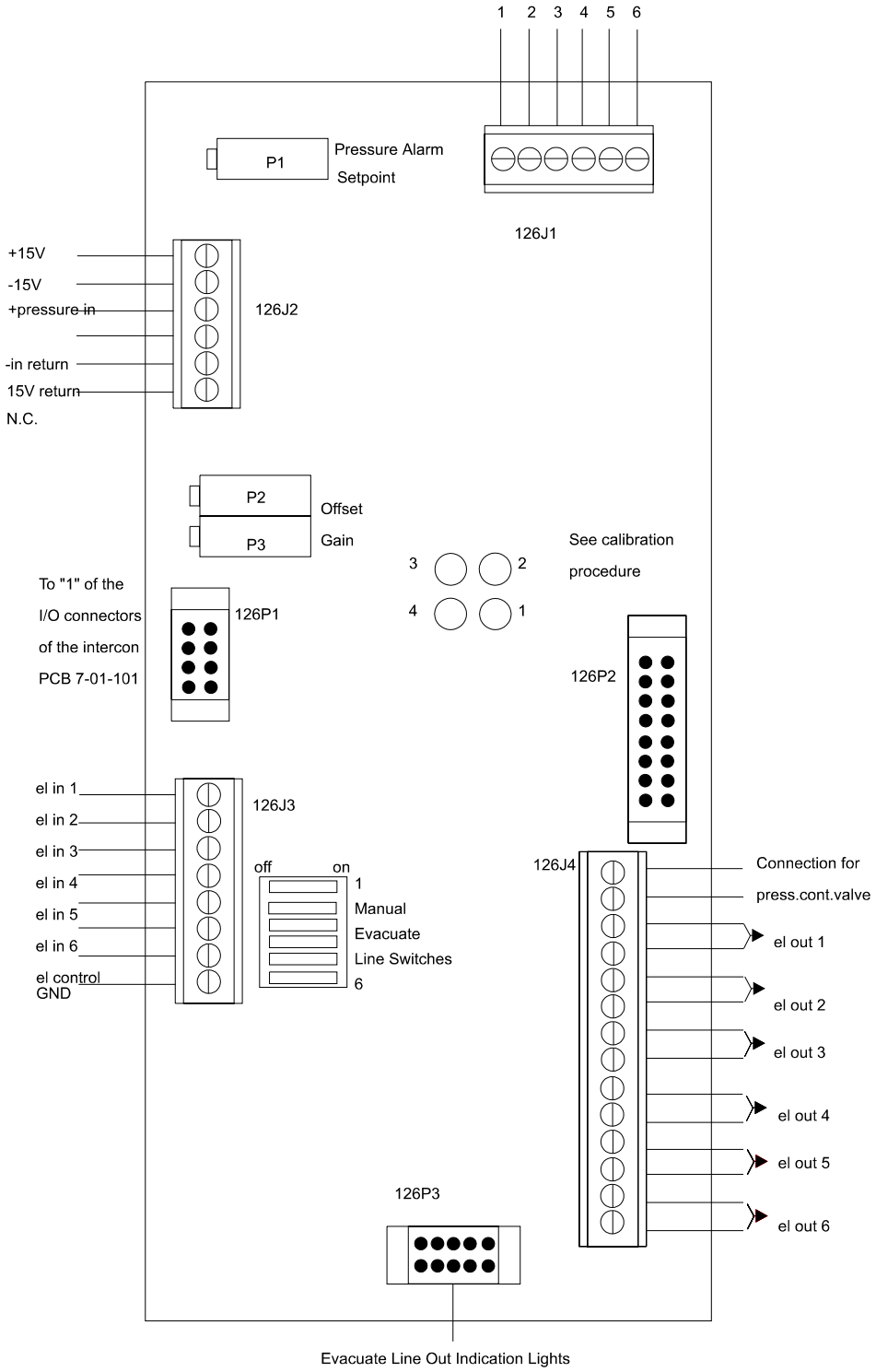


Figure 5-1 Pressure Interface Board

5.1 Connector Functions (Pressure Interface Board)

Connector 126J1: Pt 1 pressure alarm setpoint available for connecting to an analog input on the digital interconnection board.

Pt 2 NC.

Pt 3 and Pt 4 External alarm condition inputs. If external conditions are ignored, place jumper. Effect when alarm: solenoid power switches off.

Pt 5 output which may be checked by a digital input, whether the solenoid power is available or not.

Pt 6 output which must be connected to the switched 24V conditions input on the interconnection board.

Connector 126J2: A pressure transducer is connected to this connector. +15V and -15V, a power ground, an input and an input ground are available. See for connections figure (...).

Connector 126J3: On this connector are the evacuate line inputs (el1 to el6). These inputs may be controlled by outputs of the DPC via the interconnection board. Manual control is possible with use of the Dipswitch on the board, if the evacuate line control input is tied to GND.

Connector 126J4: This is the evacuate line outputs I/O connector. The pressure regulator valve must also be connected here for controlling the nitrogen flow.

Connector 126P1: This connector is tied to one of the I/O connectors on the interconnection board. One of the I/O must be programmed as a pressure regulator input/output. The control voltage is applied to Pin 2. The feedback voltage is on pin 9. The analog ground is applied on pin 3,4,5.

Connector 126P2: Power must be applied to this connector.

Pin 1,2,3 are connected to digital ground.

Pin 12,13,14 are connected to +24V.

Pin 15 is connected to +20V supply.

Pin 16 is connected to –20V supply.

Connector 126P3 The output conditions of the evacuate lines are available for LED indication lamps. LED's should be connected between the outputs and the switched 24V.

El 1 output is pin 1 of the connector.

El 2 output is pin 2 of the connector.

El 3 output is pin 3 of the connector.

El 4 output is pin 4 of the connector.

El 5 output is pin 5 of the connector.

El 6 output is pin 6 of the connector.

5.2 Calibration

The calibration requires a power supply for the input voltage, a power supply for the circuits and a DPC.

Make all the necessary connections as follows:

1. Connect the 10-lead flatcable from PC board header 126P1 to one off the I/O PC board headers on the interconnection board, and program this analog input/output as a pressure regulator.
2. Connect the supply voltages to connector 126P2.
3. A range of 0-2000 mTORR must be programmed in the chosen analog I/O for the highest accuracy. For 10 TORR a range of 10.00 needs to be programmed in the certifications.

Calibration procedure:

1. Short pressure-in (input) to in-return (analog ground).
2. Adjust potentiometer P2 until reading for the analog I/O is zero (blank).
3. Apply a voltage of 2V to the input (pressure-in and in-return) if 0-2000 mTORR on the reading is desired. Short point 1 and 2 (see fig 3).

   Apply a voltage of 10V to the input if 0-10 TORR on the reading is desired. In this case short point 3 and 4 instead (see fig 3).
4. Adjust potentiometer P3 until the reading is maximum.