

PS660 Irrigation Control Panel

Installation and Operation Instructions

si6396
revision D, 24th February 2009
catalogue section 30



Please read the following information before installing. A visual inspection of this product for damage during shipping is recommended before installation. It is your responsibility to ensure that qualified mechanical and electrical technicians install this product. If in doubt, please contact your local Murphy representative.

GENERAL INFORMATION

WARNING

BEFORE BEGINNING INSTALLATION OF THIS MURPHY PRODUCT

- ✓ Disconnect all electrical power to the machine
- ✓ Make sure the machine cannot operate during installation
- ✓ Follow all safety warnings of the machine manufacturer
- ✓ Read and follow all installation instructions

General

The PS660 provides control, instrumentation and auto/fault shutdown for an engine-driven irrigation pump. When used with a Murphy AT03069 engine throttle controller, the PS660 can also be used to automatically maintain an operator-set engine speed (in Idle mode) or pump pressure (in Duty mode).

The PS660 is available in several forms:-

Part no.	Description
B6452	An open-chassis, flat-panel design, for mounting in an acoustic or other enclosure. The panel includes a PS660 control module (41.70.0126 below), an on/off keyswitch, circuit fuses, 3 x output slave relays and a 2 metre wiring harness with screw terminal connector strip.
B6453	Similar control features to B6452, but in a weatherproof, lockable enclosure. The enclosure has a hinged door with emergency stop push-button and a window for viewing the control module display. Electrical connection is via a screw terminal strip inside the panel. Mounting is by 4 x M8 shockmounts, supplied loose.
B6452-D	Dirty water versions of the above, with a stainless steel diaphragm on the pump pressure transmitter.
B6453-D	Dirty water versions of the above, with a stainless steel diaphragm on the pump pressure transmitter.
41.70.0126	PS660 control module only, for use in a customer-designed panel or as a panel spare component. The controller features a back-lit LCD display, 5 control buttons and LED fault indicators.

Panels B6452(-D) and B6453(-D) above are supplied complete with the following engine/pump mounted sensors:-

68.MP.0058	Magnetic pickup, 5/8" x 18 UNF, 48mm long, used to sense engine speed and usually mounted in close proximity to the engine flywheel.
00.00.3042	Murphy engine oil pressure resistive sender, 2 wire, 0 – 100psi range, 1/8" NPT male fitting.
10.09.0051	Murphy engine temperature resistive sender, 2 wire, 0 – 150°C, 5/8" UNF male fitting.
PXT-600	0 – 600 PSI, 4 to 20mA pump pressure transmitter (1/4" NPT female port), with optional dirty water diaphragm (1" BSPT female port).

For optional adaptors, see "Accessories" on page 8.



Product specification

Power supply:

operating voltage: steady state range	5 – 40 V DC continuous
crank brown-out	to 0 V for >=100ms
current consumption: standby (typ)	95mA @ 12V
cranking (typ)	280mA @ 12V

Inputs:

engine oil pressure & engine coolant temperature	Murphy resistive senders (see 'accessories' below) or fault switches, wired to negative DC
pump water pressure	4 – 20 mA / 0 – 600 psi transmitter
no flow and auxiliary faults	switch contacts, closing to negative on fault
magnetic pickup:- voltage range	2.5 – 25 V AC rms
frequency measurement range	0 – 10 kHz.
engine RPM display accuracy	<= 2% of full scale
engine RPM display resolution	10 RPM

Outputs:

start, fuel and preheat: B6452/B6453 slave relays	positive DC, switched relay: 30 Amp @ 24VDC (per output), or 40 Amp @ 24VDC (combined outputs).
control module 41.70.0126	8 Amp @ 24VDC (per output), or 8 Amp @ 24VDC (combined outputs).
throttle up, throttle down and common alarm	negative DC (semiconductor), 500 mA max. @ 33 V DC

Physical:

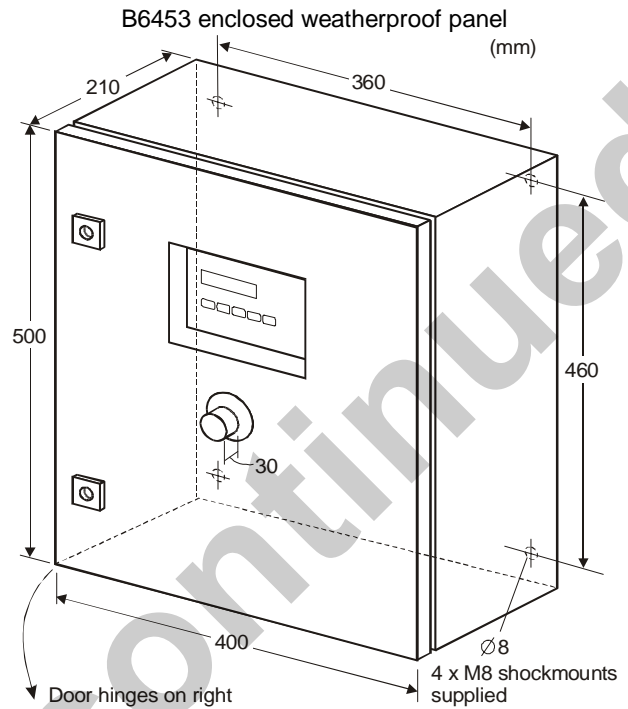
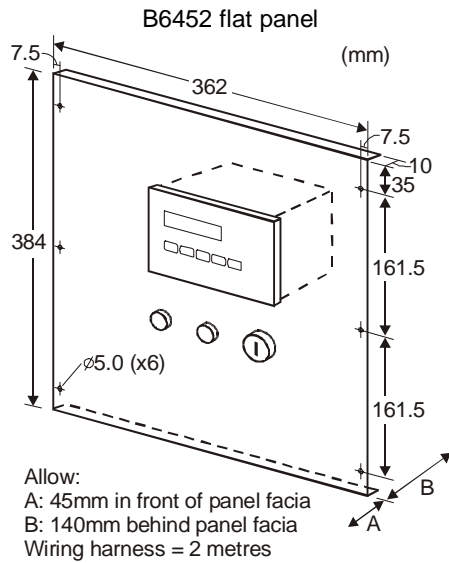
dimensions (W x H x D), weight	
enclosed panel (B6453)	400 x 500 x 240 mm, 17.5 Kg
open chassis (B6452)	362 x 384 x 195 mm, 3.9 Kg
control module (41.70.0126)	144 x 96 x 160 mm, 750 g
operating ambient temperature	-10 to +55 °C

Accessories (supplied):

magnetic pickup, 68.MP.0058	5/8" x 18 UNF, 48mm long
oil pressure sender, 00.00.3042	0-100psi, 1/8" NPTM, 2 wire
engine temp sender, 10.09.0051	0-150°C, 5/8" UNFM, 2 wire
pump pressure transducer, PXT600	0-600 psi, 4-20mA, 1/4" NPTF

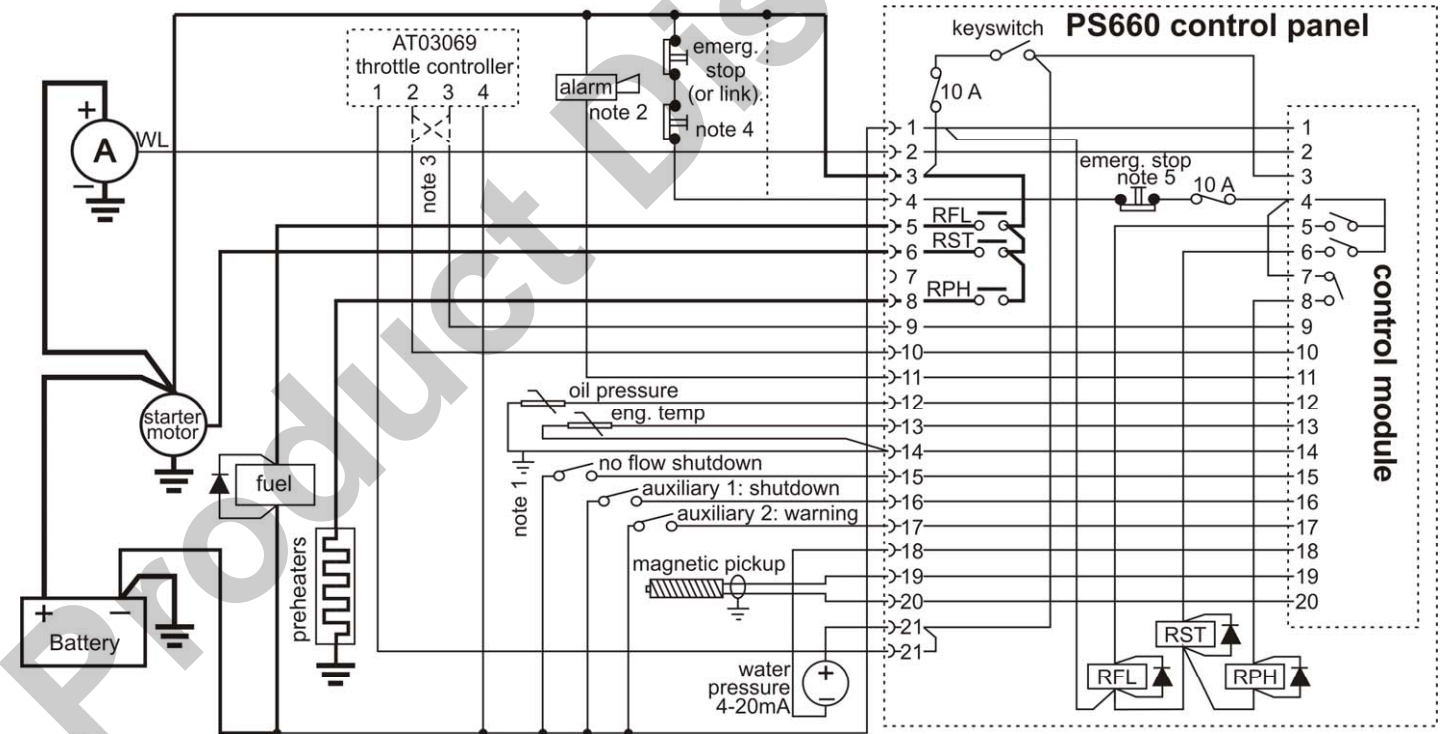
PANEL MOUNTING

Overall and fixing dimensions are shown below. Flat panel B6452 weighs approximately 3.0 Kg; enclosed panel B6453 weighs approximately 17.5 Kg. Mount the panel securely in a position that minimises vibration and ingress of dust, dirt or moisture. The positioning must also allow for wiring harness access (see 'electrical connection' below).



TYPICAL CONNECTION

Typical wiring for the PS660 is shown below. For more detailed explanation, please see the 'Electrical Connection' section following.



Notes:

1. ungrounded (2 wire) oil pressure and engine temperature senders are recommended and supplied. If grounded (1 wire) senders or fault switches are used, sender/switch ground must be connected to PS660 terminal 14.
2. 500mA max. current. For alarm devices with higher current ratings, use an additional slave relay.
3. Connect AT03069 pin 2 to rotate shaft counter-clockwise; connect pin 3 to rotate clockwise. Connect AT03069 inputs as appropriate to PS660 throttle up output (pin 9) and throttle down output (pin 10).
4. Optional connection of external emergency stop (push to break) switch. If external emergency stop is not required, connect panel terminal 4 to battery positive.
5. Emergency stop push-button fitted only to enclosed panel B6453.

Electrical connection

Panel electrical connection is via a 22-way screw terminal strip.

On panel B6452, the terminal strip is fitted to the end of a 2 metre wiring harness.

On model B6453, the terminal strip is mounted inside the enclosure at the foot of the internal chassis. Access holes must be cut in the enclosure base to allow entry of a customer wiring harness. Use appropriate wiring glands to maintain environmental sealing.

Each terminal is labelled with a number and short description. A list of terminal functions is given below. A typical connection diagram is shown on page 2 above.

**term. function
no.**


1 Negative DC power supply/ground

3 Positive DC power supply

The power supply for the control panel, normally the engine's 12V or 24V battery pack. The design is optimised for use with negative ground (earth return) systems, but may also be used with insulated (two wire) systems. **DO NOT connect the PS660 to positive earth systems.**

Pin 3 is the positive supply feed for the panel on/off keyswitch and the high current preheat/fuel/crank relays.

2 Charge fail input

Terminal 2 may be connected to the warning lamp (WL) terminal of an engine-driven charge alternator. Terminal 2 provides excitation current to the charge alternator during engine start. After engine start-up (and after the fault override time), a negative DC connection to terminal 2 causes a 'charge fail' warning fault condition: the warning  LED lights, the common alarm output operates, and the LCD intermittently indicates 'charge fail'.

If a charge alternator is not used, leave terminal 2 open circuit.

4 Emergency stop/relay feed

Pin 4 is the common positive DC feed for the control module relay contacts and panel slave relay coils. Pin 4 forms part of a fail-safe emergency stop circuit: if the control module measures an open circuit on pin 4, it immediately shuts down the engine and displays 'emergency stop'.

Connect panel pin 4 to battery positive via one or more series-connected, push-to-break, mechanically latching emergency stop push-buttons. If emergency stop controls are not required, connect pin 4 direct to battery positive.

Note: panel terminal 3 (see section above) is the high current positive feed for the panel slave relay contacts and external solenoid coils.

5 Fuel output (positive DC)

6 Starter relay output (positive DC)

7 - - No connection - -

8 Preheat output (positive DC)

These are positive DC outputs for the control of engine preheat, energised-to-run fuel and starter motor circuits.

On the PS660 control module, the maximum combined load rating for these relay outputs is 8 Amps.

On panel versions B6452 and B6453, slave relays are fitted between PS660 control module outputs and engine preheaters, starter solenoid and fuel solenoid (see 'typical connection' on page 2). Slave relay current ratings are 30 Amp max. per output, or 40 Amp maximum combined (for preheat, fuel and start).

9 Throttle up output

10 Throttle down output

These outputs can be used for optional, automatic engine throttling, to an operator-set engine speed (in Idle mode) or pump pressure (in Duty mode).

The outputs are semiconductor-based, giving a negative DC signal (current rating 500mA max.) when active.

The outputs are typically connected to the up/down control inputs of a Murphy AT series throttle controller - see 'typical connection' diagram on page 2.

See also the 'program options' section below for further information about the response of these outputs (settings for throttle increase/decrease rate, RPM dead-band and pressure dead-band).

11 Common alarm output

This is a semiconductor based output that gives a negative DC output (current rating 500mA max.) during fault or auto shutdown conditions. The output can be used to drive a suitably rated relay, alarm device or indicator lamp. It can also activate the input of a remote communication device, e.g. SMS text messaging modules such as the Murphy AMACS or GSMControl-A.

12 Oil Pressure input (Murphy resistive sender)

13 Engine Temperature input (Murphy resistive sender)

14 Sender common return/ground

These inputs can be programmed for use with engine-mounted resistive senders or fault shutdown switches.


Panels B6452 and B6453 are supplied with two-wire, insulated return Murphy resistive senders. These allow the PS660 control module to measure and display engine low oil pressure and high coolant temperature, and give programmable fault shutdown levels.

Alternatively, the controller can be reprogrammed for use with use with closed-on-fault or open-on-fault switches.

These permit auto shutdown protection, if only fault shutdown protection is required (rather than display of oil and coolant temperature), the inputs may be programmed for

(Note: one-wire, earth return senders or switches are not recommended, since ground noise can result in significant measurement errors. If one-wire senders or switches are used, pin 14 must be connected to ground.)

Each input can also be programmed with a NONE option, to allow use without any sender or switch.

After engine start-up and expiry of the Engine Override time, low oil pressure (LOP) faults result in an immediate engine shutdown; High Engine Temperature (HET) faults result in a delayed (cooldown time) shutdown. For either fault, the front facia  (shutdown) LED lights, the appropriate fault message is displayed and the alarm output operates.

ELECTRICAL CONNECTION (cont.)

- 15 No flow input: shutdown**
16 Auxiliary 1 input: shutdown
17 Auxiliary 2 input: warning only

Connect these inputs to battery negative to trigger fault warnings or automatic engine shutdowns.

Activation of the No Flow input causes the PS660 to throttle the engine back to minimum idle speed, then run the engine for the cooldown time before auto shutdown.

Activation of Auxiliary 1 input causes an immediate, latched engine shutdown. Activation of the Auxiliary 2 input causes a (non-latching) warning only. Activation of any input causes display of the appropriate fault message and activation of the common alarm output.

18 Pump pressure 4-20mA transducer input

This input measures pump pressure in conjunction with a remote 4 – 20mA / 0 – 600 psi pressure transducer. Connect pin 18 to the transducer negative terminal. Connect the transducer positive terminal to battery positive, e.g. the spare switched positive provided at panel terminal 21.

The PS660 may be configured with separate high and low pump pressure limits, and a pump override time to inhibit shutdown immediately after engine start (see

'configuration' below). A high pump pressure fault causes a timed (cooldown) shutdown. A low pump pressure fault (after the pump override time has expired) causes an immediate shutdown.

For operation without a pump pressure transducer (in Idle mode only) disconnect the transducer, and set the Pump Pressure units to "OFF" (see Configuration section below for details).

19 Magnetic pickup engine speed transducer negative 20 Magnetic pickup engine speed transducer positive

This input measures engine speed in conjunction with a magnetic pickup transducer (supplied). After correct setup in speed calibration mode (see 'configuration' below), the PS660 control module will display engine RPM and automatically release the engine starter above 500 RPM.

21 Positive DC auxiliary (2 terminals provided)

These terminals are fed from the panel keyswitch, giving a positive DC supply output when the keyswitch is in the I (on) position. The terminals may be used as a convenient positive DC feed for the 4-20mA pump pressure transducer, an external emergency stop push-buttons or auxiliary equipment.

CONFIGURATION

Control Module

System configuration and operator control is via the main PS660 control module. The module has five push button keys, a back-lit 32 character LCD display, and 2 LEDs (labelled Δ and $\text{\textcircled{I}}$) for indication of warning and shutdown faults.

The control key functions are, left to right:-

key	function
Stop	<ul style="list-style-type: none"> • During Idle or Duty modes, press and release for a timed engine cool and shutdown. • During startup or cooldown time, press and release for an immediate engine shutdown. • Following an auto shutdown, press and hold for 2 seconds to reset the system.
Start	<ul style="list-style-type: none"> • Press and release for an automatic engine start (maximum 3 attempts, 10 sec crank/rest). • Press and hold for continuous crank. <p>The Start key is also used to enter Speed Calibration Mode (details below).</p>
Mode	<ul style="list-style-type: none"> • With the engine running, press and release to toggle between Idle and Duty modes. • At any time, press and hold for 2 secs to access Program mode.
∇ Δ	<p>∇ to decrease, Δ to increase:-</p> <ul style="list-style-type: none"> • Run time (with engine stopped in standby mode) • Target engine speed (engine running in Idle mode) • Target Pump pressure (engine running in Duty mode).

The control keys are also labelled with \leftarrow , \triangleleft , \triangleright , ∇ and Δ symbols for use during PS660 configuration (in program and speed calibration modes – see separate sections below).

To operate or configure panel versions of the PS660, the keyswitch must first be turned to I (on). If the control module display does not light immediately:-

- reset the emergency stop switch by twisting clocking
- check the battery power supply connection

Configuration

The PS660 has several programmable options that **MUST** be set during pump commissioning. Murphy recommends the following 3-stage process:-

- Setup of basic engine/pump parameters: enter program mode as detailed in section A below, then configure the settings listed in section B below.
- Engine speed calibration: see section C below
- Setup of the automatic engine throttling parameters, if required: run the engine, enter program mode again and configure the settings listed in section D below.

Section A: Program mode entry and exit

Program mode allows configuration of about 15 operating parameters, including timers, trip levels, and automatic throttle settings. Many of the parameters only need to be set once for the particular pump being used, but some applications may require the operator to reset options before each pump start.

Program mode can be accessed when the panel is fully connected or with just the DC supply connected, and at any time (in standby, Idle or Duty modes):-

- If not already powered up, power up the PS660 by turning the panel keyswitch to I (on)
- Press and hold the control module **Mode** key for approx. 2 seconds.

After access to program mode, the display will show the first program parameter (preheat time). For each program mode parameter displayed, use the ∇ and Δ keys to change the

CONFIGURATION (cont.)

displayed value or option, then press \leftarrow to store that parameter and move on to the next. The parameters are set in sequence, in the order listed in sections B and D below.

After the last parameter (Pressure Down Rate) is set, the LCD briefly displays 'saving profile' before the PS660 automatically returns to normal operation.

Section B: program mode, engine/pump basic settings

The following settings should be made before any attempt to start the engine.

Parameter (default setting shown)	Description, values / options
Preheat 05 Sec $\downarrow\uparrow\leftarrow$	Sets the engine preheat time: 0, 5, 10 or 15 secs.
Engine override 05 Sec $\downarrow\uparrow\leftarrow$	Sets a time (after an engine start) for the override of an engine low oil pressure/charge fail fault: 3 to 60 secs.
Pump override 01:00 (mm:ss) $\downarrow\uparrow\leftarrow$	Sets a time (after an engine start) for the override of a low pump pressure fault: 00:10 (10 secs) to 60:00 (60 mins).
Auto duty mode? OFF $\downarrow\uparrow\leftarrow$	Sets whether or not the PS660 automatically progresses from Idle to Duty mode at the end of the Pump Override time. Regardless of this setting, the operator can (at any time) manually press the Mode key to toggle between Idle and Duty modes.
Run time: 48:00:00	Allows adjustment of the pump Run time: 00:01:00 (1 min) to 48:00:00 (48 hours), or "constant" (for continuous running). The Run time is normally set by the operator before engine starting (in Standby mode), but set-up in Program mode allows the Run time to be increased or decreased at any time, even if the engine is running. Note: the Run time displayed in Program mode is the 'current' (remaining) Run time, which, if the timer has been running, will be different from the 'initial' Run time that was set before engine starting. If the Run time is left unedited in Program mode, the previous 'initial' Run time remains unchanged (and will be displayed as the default run time before the next engine start). If, however, the Run time is changed in Program mode, the new value becomes the 'initial' Run time (the new, default value that will be displayed before the next engine start).
Cooldown 01:00 (mm:ss) $\downarrow\uparrow\leftarrow$	Sets an optional cooldown time before auto shutdown (after a 'run time expired' or operator stop, or pump high pressure / no flow faults). During the cooldown time, the common alarm output activates; if throttling is enabled, the Throttle Down output also activates. The Cooldown time can be adjusted from 0:00 (no delay) to 9:59 (10 mins). For further details, see "Operation, Engine Shutdown" below.
Oil sender type FWM analog PSI $\downarrow\uparrow\leftarrow$	Sets the oil pressure input for use with a (FW)Murphy analogue (resistive) sender, with display in either PSI or BAR; or for a low pressure fault switch (either closed-to-negative on fault or open-from-negative on fault). A "NONE" option allows the PS660 to operate without any oil pressure sensing or fault shutdown.
LOP shutdown 10 PSI $\downarrow\uparrow\leftarrow$	Sets the engine low oil pressure shutdown level. This setting is only available if the oil pressure input is set for analogue (resistive) sender.

Temp sender type FWM analog $\downarrow\uparrow\leftarrow$	Sets the engine (coolant) temperature input for use with a Murphy analogue (resistive) sender, or a high temperature fault switch (either closed to negative on fault, or open from negative on fault). A NONE option allows the PS660 to operate without any engine temperature sensing or fault shutdown.
HET shutdown 100 °C $\downarrow\uparrow\leftarrow$	Sets the engine coolant high temperature shutdown level, in °C. This setting is only available if the temperature input is set for analog (resistive) sender.
Overspeed 4000 RPM $\downarrow\uparrow\leftarrow$	The PS660 immediately shuts down the engine if the measured RPM exceeds the set limit. The setting range 1000 to 4000 RPM. In Duty mode, the PS660 automatically limits the maximum throttle speed to 500 RPM below the overspeed setting.
Pump Prssr units PSI $\downarrow\uparrow\leftarrow$	Sets the pump pressure units displayed, either PSI or BAR. An additional OFF option allows the PS660 to run (in Idle mode only) without a 4-20mA pump pressure transducer, and disables the setting and operation of the pump high / low pressure shutdowns below.
Pump Hi Pressure 500 PSI $\downarrow\uparrow\leftarrow$	Sets the pump low pressure shutdown level: 50 – 550 psi (10 psi steps) or 3 – 39 bar (0.5 bar steps)
Pump Lo Pressure 100 PSI $\downarrow\uparrow\leftarrow$	Sets the pump low pressure shutdown level: 20 – 550 psi (10 psi steps) or 3 – 39 bar (0.5 bar steps)
Throttling ON $\downarrow\uparrow\leftarrow$	ON or OFF options. Select ON to enable auto engine throttling (to a target RPM in Idle mode, and a target pump pressure in Duty mode). An OFF setting disables programming of the throttle settings detailed in section D below, and (in normal operation) disables the throttle output operation and display of target RPM/pressure.

The remaining throttle settings (throttle rate, RPM deadband and Pressure deadband) are programmable if Throttling:ON is selected above (see section D below), and then only after the speed calibration has been set. See section C

Section C: speed calibration mode

The PS660 needs to measure engine speed for correct operation of several functions:-

- display of engine speed (in RPM)
- automatic release of the starter motor after engine start (above 500 RPM)
- in Idle mode, to control engine speed (when automatic throttling is enabled)
- automatic engine shutdown if actual engine speed exceeds the programmed overspeed fault level

The PS660 measures engine speed using a magnetic pickup (supplied), which is usually mounted in close proximity to engine flywheel or gearwheel teeth. As the teeth rotate past the pickup head, the pickup generates an AC signal, the signal frequency of which is proportional to engine speed. Different engine types (with different numbers of flywheel/gearwheel teeth) mean that this circuit **MUST** be calibrated for each engine before use. With the PS660 in speed calibration mode, the operator must manually start the engine and run it to a known speed, then enter that speed into the PS660 (using the front facia keys).

CONFIGURATION (cont.)

To enter speed calibration mode, ensure the system is first powered down (panel key in position **O**). Press and hold the control module **Start** button, then power up the control module by turning the panel key to position **I**. After power up, release the **Start** button.

Once in speed calibration mode, press and hold the **Start** key again for engine preheat/cranks, and release it once the engine has fired. (There is no automatic crank release during speed calibration.)

After crank release, the PS660 counts for 5 seconds while the engine speed stabilises, during which time it displays:-

```
RPM Setup
Running: xx Sec
```

If the PS660 has not detected a speed signal after 5 seconds, the LCD displays:-

```
RPM Setup
No speed signal!
```

...followed after 3 seconds by an automatic shutdown and return to the start of calibration mode.

If a speed signal *is* detected, the LCD displays:-

```
Speed signal OK
Enter RPM xxxx
```

Use the ∇ and Δ keys to enter the actual running speed (which must be known or independently measured), then press \leftarrow (enter) to confirm this setting. The PS660 displays:-

```
Speed signal OK
Aprox XXX teeth
```

...where XXX is the calculated number of flywheel teeth. After 3 seconds, the PS660 stores the speed calibration data, stops the engine and returns to standby mode.

Section D: program mode, automatic throttle settings

Auto throttle settings - General

The automatic throttle control parameters are only available if the Throttling option is set to ON (see section B above).

There are 3 throttling parameters:-

- RPM deadband, for throttling to a set speed in Idle mode
- Pressure deadband, for throttling to a set pressure in Duty mode
- Throttle rate, affecting the throttle increase/decrease rate in both Idle and Duty modes.

The default factory settings have been chosen to give acceptable throttle control and response rates for most applications, and these settings should be tried before making any adjustments.

If the default throttle settings do not prove acceptable, the adjustment process requires a certain amount of trial-and-error: the optimal settings for each application will vary depending on the engine type, power rating, throttle response and loading.

The section following gives the programming sequence as it appears in program mode. The subsequent 'setup hints' section gives more general advice about throttle control setup.

Auto throttle settings - Program mode setup

One way to set the throttle parameters is to access Program mode while the engine is stationary. The parameters, once set, can then be tested by starting the engine and noting the throttle response to changes in set speed (Idle mode) or

pressure (Duty mode). If further adjustment is needed, the operator can stop the engine and re-program the PS660.

Alternatively, the throttle parameters can be set 'on the fly' by entering Program mode while the engine is running.

Note, however:-



WARNING: if Program mode is selected while the engine is running, the control module **Stop** key cannot be used to stop the engine. (In program mode, the **Stop** key becomes the \leftarrow key for 'entering' program values.) With Program mode selected, the engine can only be stopped by use of the Emergency Stop circuit or push-button, or by isolating the DC power, e.g. turning the panel keyswitch to **O**.

Whichever method is used:-

- Press and hold the **Mode** key to access Program mode
- Skip through the initial program mode settings (as detailed in section A) by pressing the \leftarrow (**Stop**) key several times until the "Throttle Rate" setting is displayed.
- Program the settings, which appear in the following order. See also Throttle Control Setup Hints section after these program listings:-

Throttle Rate 5 $\uparrow \downarrow \leftarrow \rightarrow$	Allows control over the rate of throttle increase and decrease. The setting range is 1 – 10 (1=slow, 10=fast); the default setting is 5. High settings give quicker throttle response but may result in control 'hunting'.
RPM Deadband \pm 100 RPM $\uparrow \downarrow \leftarrow \rightarrow$	Sets a control deadband when throttling to a target engine speed (in Idle mode). E.g. with a deadband of 100 RPM and a target speed of 1500 RPM:- <ul style="list-style-type: none"> • throttle outputs are off when engine speed is between 1400 and 1600 RPM • throttle up output activates when speed falls below 1400 RPM • throttle down output activates when speed rises above 1600 RPM The setting range is 0 – 500 RPM; the default setting is \pm 100 RPM. Low deadband values give tighter speed control but with more chance of control 'hunting'.
PRSSRE Deadband \pm 50 PSI $\uparrow \downarrow \leftarrow \rightarrow$	Sets a control deadband when throttling to a target pump pressure (in Duty mode). E.g. with a deadband of \pm 25 PSI and a target pressure of 200 PSI:- <ul style="list-style-type: none"> • throttle outputs are off when pressure is between 175 and 225 PSI • throttle up output activates when pressure falls below 175 PSI • throttle down output activates when pressure rises above 225 PSI The setting range is 0 – 200 PSI; the default setting is \pm 50 PSI. Low deadbands result in tighter pressure control but with more chance of control 'hunting'.

After entry of the Pressure Deadband, the PS660 LCD briefly displays 'saving profile' before automatically returning to normal operation.

CONFIGURATION (cont.)

Auto throttle settings - Setup Hints

In general: lower (narrower) throttle deadbands and a higher (quicker) throttle rate result in more likelihood of 'hunting' and instability; higher deadbands and a lower throttle rate result in less control accuracy and a more sluggish response to demand. A certain amount of trial and error is required to set the throttling parameters to achieve the optimum speed and pressure control.

Throttling to set speed – Idle mode:

- Press and release the start button to start the engine.
- Use the Δ and ∇ buttons to set a target speed of 1500 RPM.
- Allow the engine speed to ramp to the set speed. If the engine hunts continuously whilst trying to reach the target speed, adjust the throttle rate to a lower value. If the engine takes a long time to reach the target speed but doesn't hunt, adjust the throttle rate to a higher value.

Throttling to set pressure – Duty mode

Once the engine speed throttling is acceptable, the throttle-to-pressure settings can be adjusted.

- Ensure the pump is correctly running and primed in 'Idle' mode.
- Press and release the **Mode** button on the controller to switch to 'Duty' mode. Use the Δ or ∇ buttons to set the required Duty (target) pressure.
- Enter program mode (press and hold the **Mode** button for 2 seconds) and set the 'PSI deadband' to the required value.
- Exit program mode and adjust the Duty pressure by approx 50 psi.
- Allow the engine speed to ramp until the duty pressure is reached. If the engine hunts continuously whilst trying to reach the duty pressure, adjust the 'Prssre Up' and/or 'Prssre Down' rates to a lower value. If the engine takes a long time to reach the Duty pressure but doesn't hunt, adjust the 'Prssre Up' and/or 'Prssre Down' rates to a higher value.

OPERATION

Operation

Standby

On panel versions of the PS660, turn the key to I to power up the system. The PS660 controller momentarily displays the firmware version and engine 'hours run' value, followed by:-

Standby	↓↑
Runtime:hh:mm:ss	

The run time displayed is retrieved from non-volatile memory (from the previously used or programmed RUN time setting). Before engine starting, the operator can increase or decrease the RUN time using the ∇ and Δ keys. Adjustment range is 00:01:00 to 48:00:00 (1 min to 48 hours) in one minute increments, or a 'CONSTANT' option for continuous running.

The Run time can also be changed once the engine is running – see Program mode above for details.

Engine startup

Once the required run time is displayed, press and release the **Start** key for an immediate, automatic engine start. The LCD displays the engine preheat time (if enabled) and crank (starter motor) status/timing. Crank release is automatic once the engine fires and speed rises above 500 RPM.

If the engine does not fire after 10 seconds cranking, the PS660 releases the starter motor, waits for a 5 second crank rest period, then repeats the start sequence. The PS660 makes 3 attempts to start the engine before signalling a 'start fail' shutdown fault.

Alternatively, for continuous engine cranking (e.g. to purge fuel lines), press and hold the **Start** key. The crank output only then de-activates on release of the **Start** key, or if the PS660 detects engine speed above 500 RPM.

Idle mode

After a successful engine start, the PS660 enters 'Idle' mode, allowing the pump to fill the irrigation lines and build pressure.

The display top line reads "Idle" and (if throttling is enabled) the target engine RPM and $\downarrow\uparrow$ symbols. The display bottom line shows (automatically scrolls through) actual engine and pump parameters, e.g. pump pressure, engine speed, hours run, oil pressure, engine temperature and pump override time.

The operator-set Run time is also displayed, but is held at its initial value. (The Run time can be changed at any time by entering Program mode.)

If engine throttling is enabled, Idle mode allows the engine to run at an operator-set target speed (in RPM). The initial target speed (displayed on the top line) is the speed measured immediately after engine startup. To decrease or increase the target speed, press the front facia ∇ and Δ keys: the PS660 then automatically throttles the engine to maintain the new target speed.

If engine throttling is disabled, the display top line does not show any target RPM, and throttle outputs are disabled.

In Idle mode, the PS660 runs for an indefinite period, until the operator either presses the **Mode** key (to go to Duty mode – see below) or presses the **Stop** key (to stop the engine), or unless the program mode 'Auto Duty: On' option has been set (in which case the PS660 automatically progresses to Duty mode at the end of the Pump Override time).

Duty mode

In Duty mode, the PS660 runs the pump for the operator-set Run time, or indefinitely if the Run time is set to "CONSTANT". If throttling is enabled, the PS660 throttles the engine to maintain an operator-set target pump pressure.

The display top line read "Duty" and (if throttling is enabled) the target pump pressure and $\downarrow\uparrow$ symbols. The bottom line continues to scroll through actual engine/pump parameters and also the Run time, which begins to count down.

If engine throttling is enabled, the initial target pump pressure (displayed on the top line in PSI or BAR) is the pressure measured immediately on selection of Duty mode. To decrease or increase the target speed, press the front facia ∇ and Δ keys. The PS660 automatically throttles the engine to maintain the new target pressure.

At any time, the operator can toggle between Duty and Idle modes by pressing and releasing the **Mode** key.

When toggling from Duty to Idle mode, the Run timer (if active) will pause but not reset, and will resume counting if Duty mode is re-selected. At any time, the remaining Run time can be increased or decreased by entering Program Mode.

OPERATION (cont.)

Note: The PS660 can only operate in Duty mode if there is a valid pump pressure measurement. If the 4-20mA pressure transducer fails, the PS660 initiates a cooldown/shutdown sequence (see section below). The PS660 can operate without a pressure transducer (by programming the Pressure Units setting to "OFF"), but it will only run the pump in Idle mode, without the Run timer. If throttling is enabled, the PS660 will throttle the engine to an operator-set speed (not pressure).

Engine shutdown

An engine shutdown can be manually initiated from the front facia **Stop** key, or automatically initiated in response to engine/pump fault or end-of-run time conditions. Depending on the circumstances, the shutdown may be immediate, or may include a controlled 'cooldown' delay.

Immediate shutdowns

The PS660 immediately shuts down the engine (i.e. fuel and throttle up outputs deactivate, throttle down output activates) in the following circumstances:-

- if the operator presses the **Stop** key during an engine start sequence or during the cooldown time.
- on detection of the following faults:-
 - emergency stop, engine overspeed or auxiliary input 1 faults (at any time)
 - engine low oil pressure or high coolant temp input faults (once the engine override time has expired)
 - low pump pressure fault (once the pump override time has expired)

After an engine shutdown, the front facia **(I)** (shutdown) LED lights continuously and the common alarm output also operates. The display shows any remaining run time and the reason for the shutdown, e.g.:-

SHUTDOWNhh:mm:ss LOW OIL PRESSURE

This latched shutdown state is maintained until the operator switches the keyswitch to **O**, or removes DC power, or presses and holds the **Stop** key for 2 seconds.

Controlled shutdowns with cooldown delay

The PS660 enters a cooldown period (initial time as set in program mode), followed by an engine shutdown, in the following circumstances:-

- in Duty or Idle modes, if the operator presses the **Stop** key.
- in Duty mode, if the Run timer expires
- on detection of the following faults:-
 - high pump pressure (providing the pump override time has expired)
 - no flow (providing the pump override time has expired)
 - magnetic pickup failure (providing the engine override time has expired)
 - pump pressure 4-20mA transmitter failure (providing the transmitter isn't disabled using a Prsr Units: OFF setting.)

During the cooldown time:-

- The common alarm output is active
- The front facia **(I)** (shutdown) LED flashes.
- The throttle down output is on and the throttle up output is off. (The operator cannot control throttling during cooldown.)

- The display top left shows the reason for the timed shutdown.
- The display top right shows the remaining cooldown time.
- The bottom line continues to display pump pressure, plus scrolling engine/pump parameters and any remaining run time. (Note: the Run timer does not count down during the cooldown time, but is held at its last value.) Typical displays include:-

END OF RUN mm:ss XXXPSI o/r

PRESSURE HI mm:ss XXXPSI XXXXrpm

MANUAL STOP mm:ss XXXPSI oil XX

PICKUP FAIL mm:ss XXXPSI tmp XX°C

NO FLOW mm:ss XXXPSI hrsHHHHH

4-20MA FAIL mm:ss XXXPSI hh:mm:ss

The cooldown timer continues to count down, and the original reason for the timed shutdown remains displayed, even if the original fault clears or other faults subsequently occur. At the end of the cooldown time, the PS660 shuts down the engine in a latched fault mode:-

- the common alarm and throttle down outputs remain active
- the front facia **(I)** (shutdown) LED light goes from flashing to continuous
- the display top left reads "shutdown"
- the display top right shows any remaining Run time.
- the display bottom line shows the reason for shutdown, e.g.:-

SHUTDOWNhh:mm:ss END OF RUN

SHUTDOWNhh:mm:ss PUMP PRESSURE HI

SHUTDOWNhh:mm:ss PUMP NO FLOW

SHUTDOWNhh:mm:ss MANUAL STOP

To reset this latched shutdown state, turn the keyswitch to **O**, or remove the DC power supply, or press and hold the **Stop** key for 2 seconds.

Note: the cooldown delay does NOT inhibit immediate engine shutdowns due to low oil pressure, low pump pressure, aux input 1, overspeed or emergency stop faults. These immediate shutdowns will override the display of any 'cooldown' (fault) message. The operator can also stop the engine immediately by pressing the **Stop** key.

Warning only faults:

The charge fail terminal (pin 2) and auxiliary input 2 (pin 17) can be used to provide warnings about non-critical (non-shutdown) faults. Activation of these inputs does not cause an engine shutdown, but does cause:-

- periodic display of the appropriate fault message: the message is displayed for approximately 2 seconds in every 10 seconds.
- continuous lighting of the front facia **(A)** (warning) LED
- continuous operation of the common alarm output, which may be used to drive an audible alarm and/or warning lamp circuit.

Operation of the charge fail warning is overridden during standby, engine starting and until the end of the engine override time. Auxiliary input 2 (pin 17) is not overridden: the warning occurs immediately after input activation.

WARRANTY & MAINTENANCE

The PS660 is supplied with a 2 year limited warranty on parts and workmanship. Full details of our warranty terms are available at www.fwmurphy.co.uk/warranty.

The PS660 is designed to be largely maintenance free. Maintenance is limited to checking for:-

- secure electrical connection of the engine wiring harness
- secure fixings / vibration mounts
- excessive dust / dirt build-up or moisture ingress, e.g. around door/cover seals and cable glands.
The PS660 external facias may be cleaned using a damp, lint-free cloth.

Once the warranty period has expired, the panel design allows competent personnel to access and replace certain components: please contact your nearest Murphy representative for further advice. No attempt should be made to dismantle the main PS660 control module.

Accessories

Optional adaptors (please specify at order) for engine-mounted senders include:-

- | | |
|------------|--|
| 65.00.0242 | Oil pressure sender adaptor,
M10 x 1.25 male to 1/8" NPT male |
| 89.09.0202 | 1/8" NPT female to 1/8" NPT female,
swivel, straight |
| 85.04.0202 | 1/8" NPT female to 1/8" NPT female,
swivel, right-angled |

Product Discontinued



FRANK W MURPHY LTD.
Church Road, Laverstock, Salisbury, SP1 1QZ, United Kingdom
tel: +44 (0)1722 410055 **fax:** +44 (0)1722 410088
email: sales@fwmurphy.co.uk **web:** www.fwmurphy.co.uk



USA - ISO9001:2000 FM 28221
UK - ISO9001:2000 FM 29422

In order to consistently bring you the highest quality, full featured products, we reserve the right to change our specifications and designs at any time.