

Functions and features

- Auto start sequence control
- Auto start fuel enrichment / SPR activation
- Auto start ignition delay for high residual temperatures
- Alternative procedure to manually delay start ignition
- Start declines for bus voltage, residual TT, and SFE/SPR
- Simple and distinct motor and start cycle initiation
- Start abort and shutdown guidance via an annunciator
- Auto-relight / continuous ignition options for flight
- Tracking of start and flight cycles, hours and more

Simple install. Simple operation.

Since the TPE-331 first appeared in the early 60's, digital control have advanced in strides. As system performance improved, the installations became less complex, and so too operator interaction. Press an engine "start" button to begin an auto start sequence. Press a "motor" button for a motor/vent cycle. To abort or end any of these two cycles simply press an engine "stop" button.

Auto start sequence

Beginning a start cycle the TSLM system engages the starter and oil vent valve cranking the engine up to at least 10% RPM before opening the fuel shutoff valve and actuating the igniters. After combustion (light-off) the engine accelerates through the critical RPM range and 60% RPM at which point the igniters, starter and oil vent valve are de-energized, with engine speed then stabilizing at idle. The start sequence can be aborted at any moment whether for lack of cranking performance, failure to light-off, dwelling in the critical RPM range, hung start, or to prevent a hot start.

Fuel enrichment SFE/SPR

The TSLM system actuates the SFE/SPR valve to not only improve fuel atomization to obtain good combustion (light-off) but to promote acceleration thereafter by regulating turbine temperature (ITT/EGT) close to optimum. If desired the system can also close the SFE/SPR valve for a short time as the turbine temperature first rises past a set point so that the pilot can check for a slower rate of temperature rise to verify correct valve function and abort the start if needed.



Delaying ignition

To start an engine with high residual turbine temperature, typically due to a recent shutdown, the TSLM system will automatically delay engaging ignition and opening the fuel shutoff valve to 15% RPM (instead of the normal 10%) during the start cycle for the added cooling gained before light-off. Alternatively to manually delay start ignition a procedure can be followed of first doing a motor/vent cycle then switching over to a start sequence by pressing the start button/switch at the desired time to ignite the fuel. Starter continuity will be kept through the switch-over.

Start declines

The TSLM system is able to decline a start before engaging the starter if bus voltage is too low, residual turbine temperature is too high, or if the start fuel enrichment valve is disconnected. An error code will indicate via the TSLM light which the pilot can reset. These start decline checks are there to aid if desired, can be tailored to application needs and may be entirely overridden if needs be.

Operator guidance

To further aid operation even in a small way the TSLM system can provide guidance/cues to a pilot via an annunciator. During engine start cycles it can suggest aborts to prevent hot starts, dwelling in critical RPM range, failed starts, and insufficient cranking performance. It will also suggest terminating a motor/vent cycle at reaching 15% RPM, and whenever depressing the engine stop button/switch during shutdown let you know when the recommended 5 seconds have lapsed. Many of these can be configured according to application preference.

Motor/vent cycle

Depressing the motor button/switch begins a motor or vent cycle which only engages the starter and oil vent valve. No ignition or fuel is introduced so that the engine can be cleared of residual fuel or vapors. By depressing the engine stop or motor button/switch again terminates the motor/vent cycle.

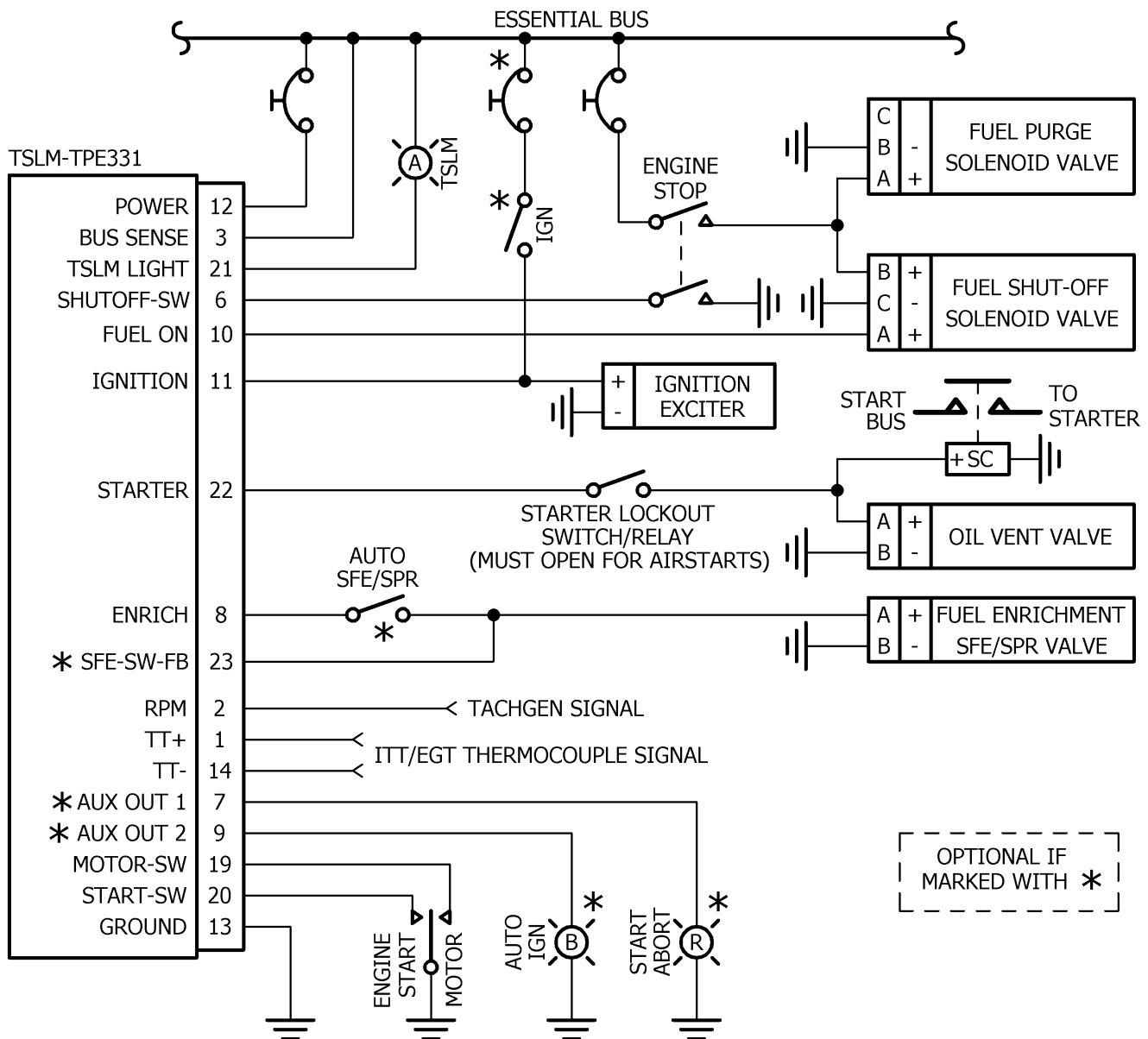
Anti flame-out measures

While in flight auto-relight and continuous ignition modes can be activated via the TSLM system to combat and/or prevent flame-out. In auto-relight mode the system automatically runs the igniters in the event of decaying RPM, and discontinues them when engine operation returns to normal. Continuous mode will keep the igniters sparking continuously usually required when ice shedding is in

progress. Ignition mode selection is made via the start and motor button/switches. Holding one or the other for half a second will cycle the system through the modes - auto-relight, normal (off), and continuous. Which mode is currently engaged is indicated via the TSLM light or via another dedicated annunciator.

Tracking and logging

The TSLM tracks various operational data such as start cycles, flight cycles, hours above 60% (RPM), and hours above 80% (flight). In addition it holds the performance data of the last start or motor/vent cycle executed such as time to 10% RPM, time in critical RPM, time to idle, minimum bus voltage, and maximum turbine temperature. The TSLM is supported by our LSI logger interface that can record everything the system does throughout its life.



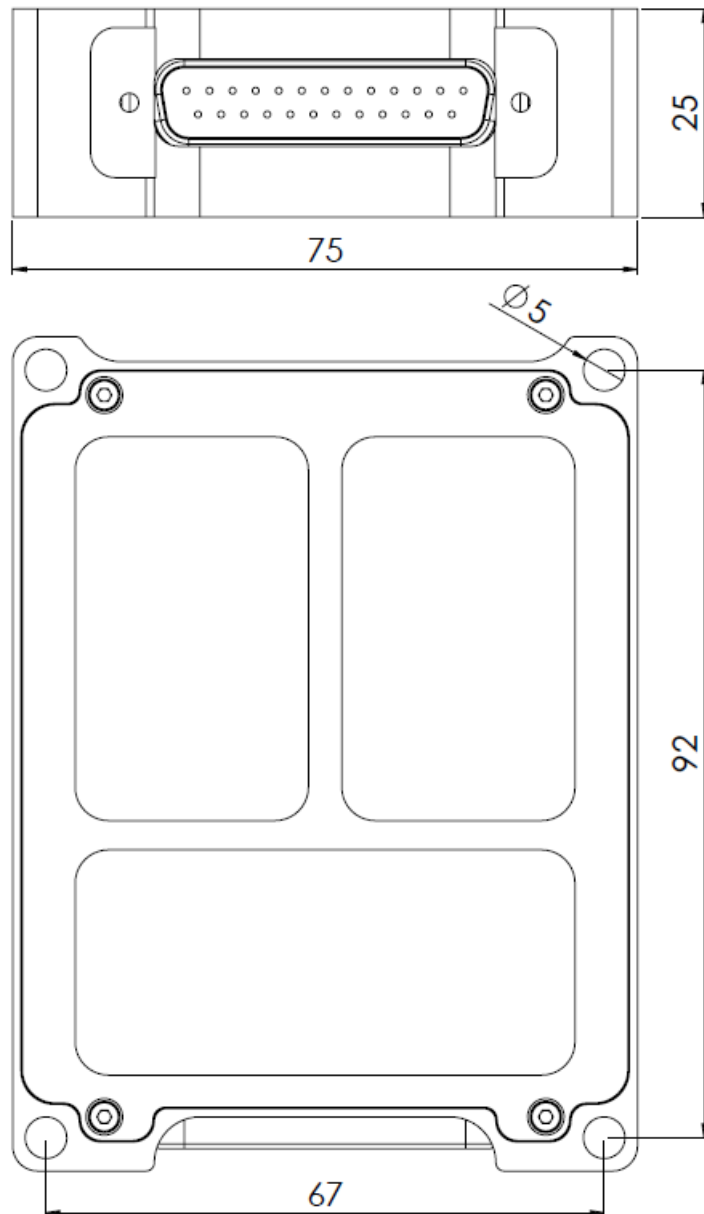
Pin-outs (male 25-pin d-sub)

PINS	DIR	LABEL	FUNCTION
12,24	IN	POWER	AIRCRAFT POWER (28VDC)
13	GND	GROUND	AIRCRAFT GROUND
2	IN	RPM	SENSES ENGINE SPEED/RPM (TACHGEN)
1	IN	TT+	SENSES (EGT/ITT) TURBINE TEMPERATURE (K-TYPE THERMOCOUPLE +)
14	IN	TT-	SENSES (EGT/ITT) TURBINE TEMPERATURE (K-TYPE THERMOCOUPLE -)
3	IN	BUS SENSE	SYSTEM BUS VOLTAGE SENSE
6	IN	SHUTOFF-SW	SENSES ENGINE "STOP" BUTTON PRESS
20	IN	START-SW	SENSES ENGINE "START" BUTTON PRESS
19	IN	MOTOR-SW	SENSES ENGINE "MOTOR" BUTTON PRESS
11	OUT	IGNITION	POWERS THE IGNITION EXCITER(S) TO SPARK THE IGNITERS
22	OUT	STARTER	POWERS THE STARTER CONTACTOR, OIL VENT VALVE, FUEL HEAT LOCKOUT VIA STARTER LOCKOUT SWITCH/RELAY
10	OUT	FUEL ON	POWERS THE FUEL SHUTOFF VALVE TO OPEN FUEL
7	OUT	AUX OUT 1	AUX. OUTPUT 1 TO OPTIONALLY CONTROL AN ANNUNCIATOR
9	OUT	AUX OUT 2	AUX. OUTPUT 2 TO OPTIONALLY CONTROL AN ANNUNCIATOR
8	OUT	ENRICH	POWERS START FUEL ENRICHMENT VALVE (SPR) VIA AN OPTIONAL AUTO-SFE/SPR SWITCH
23	IN	SFE-SW-FB	SENSES THE POSITION OF THE OPTIONAL AUTO-SFE/SPR SWITCH
21	OUT	TSLM	CONTROLS THE "TSLM" STATUS LIGHT
5	I/O	CAN-H	CAN BUS HIGH LINE TO SECOND DEVICES LIKE THE DX-1, LSI, ETC.
18	I/O	CAN-L	CAN BUS LOW LINE TO SECOND DEVICES LIKE THE DX-1, LSI, ETC.

General Specifications

1	Operational Voltage Range	10 – 40 VDC
2	Operating Temperature Range	-40 to +85 °C
3	Max. Operating Altitude	55,000 feet
4	Dimensions	100 x 75 x 25mm
5	Weight	180 g
6	Power Consumption (no external loads)	50mA

Unit Outline



1. The TSLM uses a 25-pin DSUB (M24308 series) male connector. The recommended mating receptacle (female) for it is the M24308/2-3
2. The unit is secured through four 5mm holes on each corner accepting AN3 bolts