

M300DP

Expansion I/O Module
for MBW L Series Control Panels



Installation / User Manual

M300DP Expansion I/O Module

with AutoStart

P/N: MN10058-00

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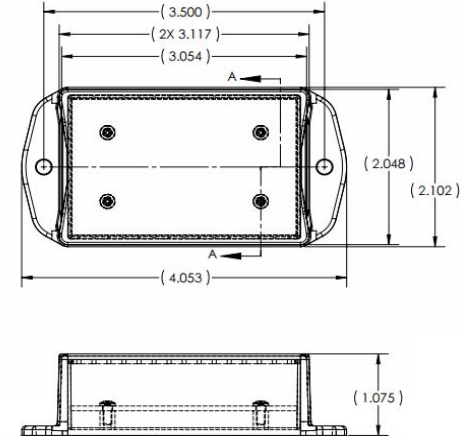
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Connection Details

Connector	Description
P4	6 Pin; connects to , black housing
S1	6 Pin; connects to P1r, grey housing
CAN	Yellow & Green wires
Oil Pres, Fuel	Analog Inputs - Orange, Green/Black wires
DI1 / DI2	Discrete Inputs - White/Black, White, Black
Common	Common – connects to Throttle Switch, Black

Mechanical Mounting

The Auto Start module has two mounting holes 0.18 Diameter or # 8 screws. The mechanical dimensions are shown in the figure.



Updating Display Software

In order for the display to recognize the Auto Start module, the display software must be revision v2.00 or higher. Go to the System Menu and scroll down to ABOUT M154. Hold *MODE* to view the software version screen. When the Auto Start module has been installed, the SW Version for the M300DP will also be displayed.

ABOUT M154L
SW1023 Rev:2.00
M300DP Rev:1.30
YANMAR T4F

If your software needs updating, contact your local distributor for the latest software revision.

Insert Auto Start Leads into the Engine Connector

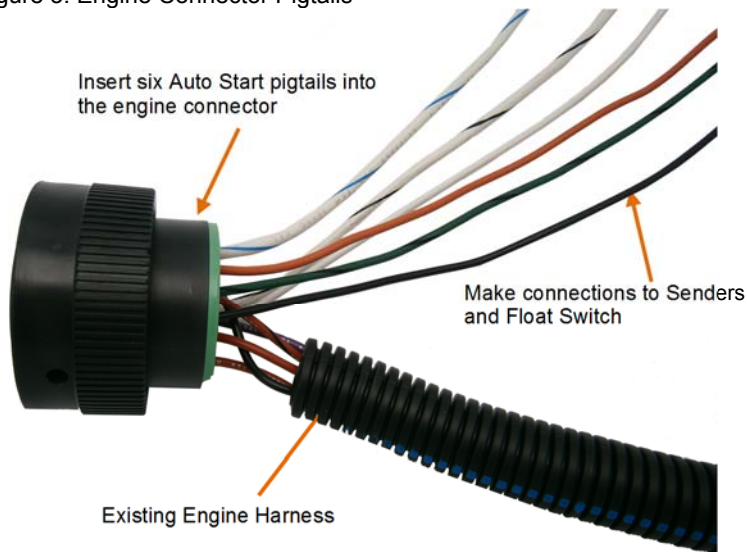
The Auto Start module provides six wire leads from the module to support two analog inputs, two discrete inputs and an alarm. These leads must be inserted into the P1 connector. The recommended pin locations are shown in the table below.

Make External Connections

To connect the two analog signals and the two discrete inputs to the device(s), five pigtails are provided and must be inserted into the Engine harness. The recommended pin locations are shown in Table 4.

The installer is responsible for making the connection from each pigtail to the device(s) (Oil Pressure Sender, Fuel Sender, Float Switch, etc.).

Figure 3. Engine Connector Pigtails



Alternate Connection

Although the installation instructions show the analog and discrete inputs going to the 21 pin engine connector they could also be grouped together on a separate 6 pin connector (DT04-6S).

Quick Start Guide



Powering the System

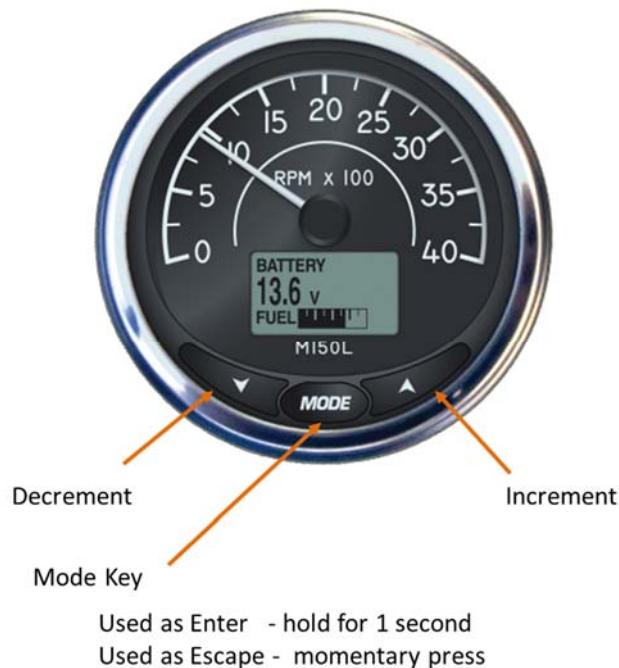
The M300DP Expansion I/O control module is a dual mode system and can be programmed for either Auto Start (A/S) or expansion I/O capability. The M300DP can be used with all M150B and M150L Series Control Panels.

To power the system turn the key switch to the “ON” position. This will activate the control panel and apply power to the M300DP module and the engine ECU. Should the control panel indicate a fault condition review the M150 Series manual for details and correct the condition before starting the engine.

On a successful power up sequence, the system will display the currently configured default display. The factory default display is Engine Speed.

Changing Data Displays

To change the data being displayed press the “▼” or “▲” buttons to access additional data displays.



Connect the Auto Start Module to the Display

The following four steps provide the detailed modifications to the control panel harness required for the Auto Start module.

1. Remove the wedgelock and the Yellow wire from the P3 connector and insert the Yellow wire from the Auto Start module into the vacated pin location (Pin 3).
2. Remove the Green wire from the P3 connector and insert the Green wire from the Auto Start module into the vacated pin location (Pin 4).
3. Re-install the wedgelock and plug the P3 connector into the display.

Connect the Auto Start Module to the Keyswitch

The following four steps provide the detailed modifications to the control panel harness required for the Auto Start module.

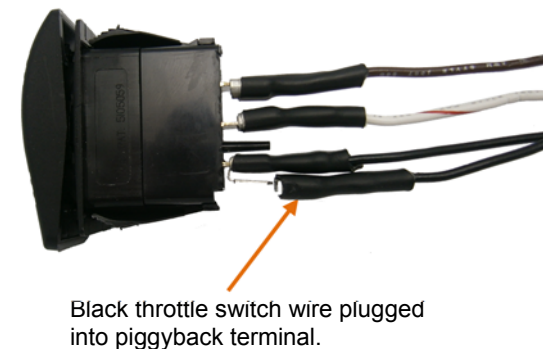
1. Remove the P1 connector from the keyswitch and install the P4 connector of the Auto Start module into the keyswitch.
2. Remove the wedgelock and insert the Yellow wire removed from the display connector into pin 6 of the P1 connector.
3. Insert the Green wire removed from the display connector into pin 3 of the P1 connector.
4. Re-install the edgelock and plug the P1 connector into the S1 connector of the Auto Start module.

Connect the Auto Start Module to the Throttle Switch

The following steps provide the detailed modifications throttle switch.

1. Remove the black wire from the throttle switch and install the black wire with 1/4 " quick disconnect.
2. Re-install black throttle wire onto the piggyback terminal.

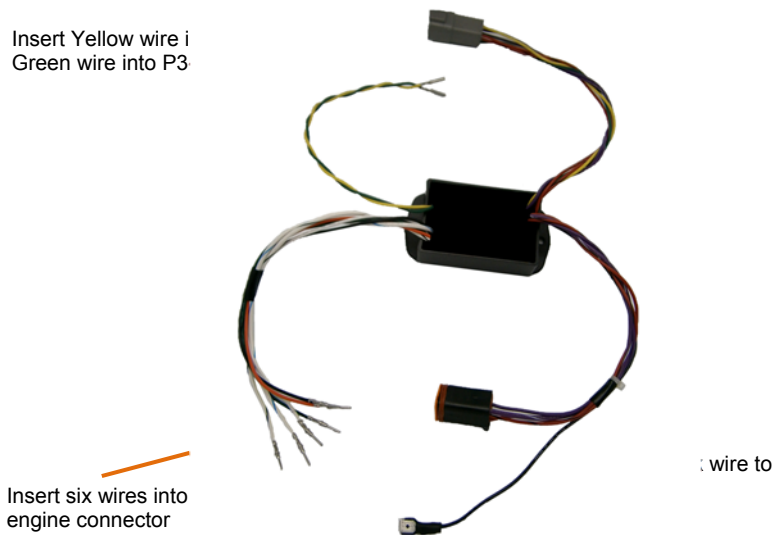
Figure 2. Throttle Switch Connection



Re-Assemble

9. Mount the Auto Start module.
10. Connect the control panel connector (HDP24-21 connector) to the engine harness.
11. Re-install the control panel.
12. Connect battery.
13. Turn ignition key to “ON” position.
14. Ensure digital display is active. If display is not active;
 - a. Check battery and power connections.
 - b. Check ignition switch is on position.
15. Ensure system is displaying data for engine speed, oil pressure and temperature.

Figure 1. Expansion I/O Module



MP300DP System Operation

Menu Navigation

The Mode Button is multi-functional and is used as an escape and enter key. When the Mode key is pressed for less than 1 second it is considered an escape action. When pressed for greater than 1 second is considered an enter function. For example, to enter a menu selection or save an entered value the button must be pressed and held for greater than 1 second. When escaping a menu selection, momentary Mode Button presses are used. The only exception to these actions is entering the main menu. From any runtime data display screen a momentary press of the Mode Button will activate the main menu.

Main Menu

The Main Menu allows the user to access all areas of the M150L Control System. To access the Main Menu press the Mode button. To access menu items highlight the desired selection using the “▼” or “▲” keys and press & hold the *MODE* for 1 second.



**HOLD MODE
TO ENTER
FAULT CODES
CONTRAST
DISPLAY
ENGINE
REGENERATION
FUEL SETUP
LIGHTING
RST MAINT TMR
M300DP MODULE
SYSTEM**

M300DP Module Setup

To access the M300DP menu, press on the *MODE* key to view the Main Menu. Press the “▼” or “▲” keys until “M300DP Module” is highlighted. Press and hold *MODE* > 1 second to enter the M300DP submenu.

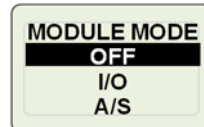


NOTE: The M300DP Module menu selection will only be visible if the M300DP is correctly installed and has CANbus communication with the M150L series display.

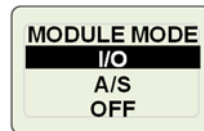
M300DP Modes

The M300DP has three modes which determine how the module operates as well as the structure of the M300DP menu within the display.

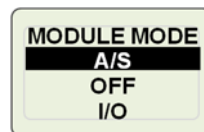
OFF: AutoStart functionality is disabled. Configurable digital inputs are disabled. The two additional analog inputs are still available and are a shared setting between all three modes.



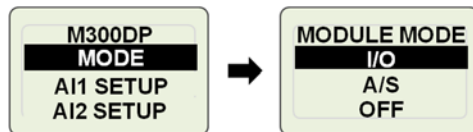
I/O: Two configurable DI's can be set as engine stop, start, inhibit, or programmable speed inputs. Analog inputs remain the same. No autostart functionality.



A/S: Autostart mode uses the DI's to automatically start and stop the engine while key switch is in the “Auto” position. A customizable three speed throttle profile controls the engine speed during startup and shutdown.



To view the current M300DP Mode, press and hold the *MODE* key > 1 second while the *MODE* selection is highlighted. To change the mode, use the “▼” or “▲” keys to highlight the desired mode. Press and hold the mode key to save and confirm the change.



Appendix B – Field Installation

Making the Connections

The Expansion I/O Module shown in Figure 1, has two floating connectors (P4 and S1), 6 wire leads to be connected to the Engine connector, one black lead with a piggyback quick disconnect which goes to the throttle and two leads (Yellow and Green) which go to the .

Also provided are six 6” pig tails (White w/Blue, Orange, Green w/Black, White, White w/Black and Black) which can be used on the engine side of the engine connector to make remote connections to analog and discrete inputs.

Recommended order:

1. Verify the battery / battery switch connections to engine per the engine installation diagram. (Refer to engine manufacturer installation manual.). Verify engine is bonded to battery return (-). Verify engine block is connected to battery ground.

2. Disconnect battery.

Control Panel Modifications

3. Loosen the four screws (3/32 Hex) and remove the control panel from the housing base. Disconnect the control panel from the engine harness (HDP24-21 connector).
4. Make connections from the Auto Start module to the display. MORE DETAIL IN NEXT SECTION
5. Make connections from the Auto Start module to the keyswitch
6. Make a connection to the throttle switch
7. Insert the 6 wire leads from the Auto Start module into the 21 pin engine connector (HDP24-21 connector).

Engine Harness Modifications

8. Make external connections to the Oil Pressure Sender, Fuel Sender, Digital Input 1, Digital Input 2 and Common to the 21 pin Deutsch connector of the engine harness using the five 6” pigtails.

Troubleshooting Guide

Symptom	Action
The M300DP Menu Selection does not show up in the Main Menus	<ul style="list-style-type: none"> Check the Yellow and Green wires from the A/S Module and the Display Check the keyswitch connection (Black Wire) Make sure the M150 Series software version is version 2.0 or higher.
Engine does not crank when keyswitch is in normal Start position	<ul style="list-style-type: none"> Check pin D (i.e., Start) connection to the Engine Connector.
Engine cranks but does not fire when keyswitch is in normal Start position	<ul style="list-style-type: none"> Check Engine manual for troubleshooting start issues.
Auto Start ALERT not displayed when keyswitch set to Auto Start (Full Counterclockwise position) .	<ul style="list-style-type: none"> Check the settings to make sure the mode is set to A/S
With a discrete input set to Start/Stop, the Auto Start Alert screen is displayed but turns off and then on again	<ul style="list-style-type: none"> Make sure the On Delay set for the discrete input are longer than the time the discrete input is bouncing.
Engine running but shuts down unexpectedly; then restarts.	<ul style="list-style-type: none"> Make sure the Off Delay set for the discrete input are longer than the time the discrete input is bouncing.
The auto start countdown does not start when the discrete input is activated	<ul style="list-style-type: none"> Make sure DI1 and DI2 are correctly set for Start and Stop Make sure the Active State for DI1 and DI2 are set correctly Make sure the discrete input wires are inserted into the correct pin locations of the Engine Connector.
The data for the senders on to an analog input does not show up as an Engine parameter.	<ul style="list-style-type: none"> Make sure the analog input wires are inserted into the correct pin locations of the Engine Connector.
The data for the senders connected to an analog input shows up on the Engine display but the values are wrong	<ul style="list-style-type: none"> Make sure the sender selection for the analog input are set to the correct sender option (US versus Euro)

I/O Mode Operation

Input / Output Mode (I/O Mode)

Selecting I/O disables the Auto Start Feature but allows the DI1 and DI2 inputs to be used as I/O. The AI1 and AI2 analog inputs will be active.

**M300DP
MODE**
AI1 SETUP
AI2 SETUP
SPEED 1
SPEED 2
DI1 SETUP
DI2 SETUP
IO STATUS
RESET DFLT5

AI1 and AI2 Setup

The M300DP Module has two analog inputs which may be configured for a number of senders. When the analog sender has been connected and the setup complete, the corresponding screen will be added to the rotating display list.

AI1 SETUP
Off
Fuel US
Fuel Euro
Water Lev US
Water Lev Euro

Off
Fuel US (240-33 ohms)
Fuel Euro (10 – 180 ohms)
Water Level US (240-33 ohms)
Water Level Euro (10- 180 ohms)

Use the “▼” or “▲” keys to highlight the desired sender type. Press and hold mode to save the selection or quick press mode to discard any changes.

Speed 1 / Speed 2 RPM

The I/O Mode supports the setup of two different engine RPMs. These speed settings are bounded by the MIN / MAX RPM in the Engine menu. When a DI configured as Speed 1 or Speed 2 is activated the display will command the engine to the configured RPM.

Use “▼” or “▲” keys to set Speed 1 RPM or Speed 2 RPM.



DI1 and DI2 Setup

The DI1 Setup and DI2 Setup are used to program the operation of the two discrete inputs.

DI1 and DI2 Function

The DI1 or DI2 inputs are used to control the engine and may be configured as Off, Stop, Speed1, Speed2 or Start Inhibit (Start Inh) as defined in Table 1.

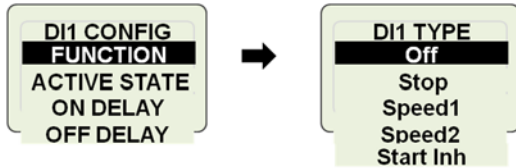
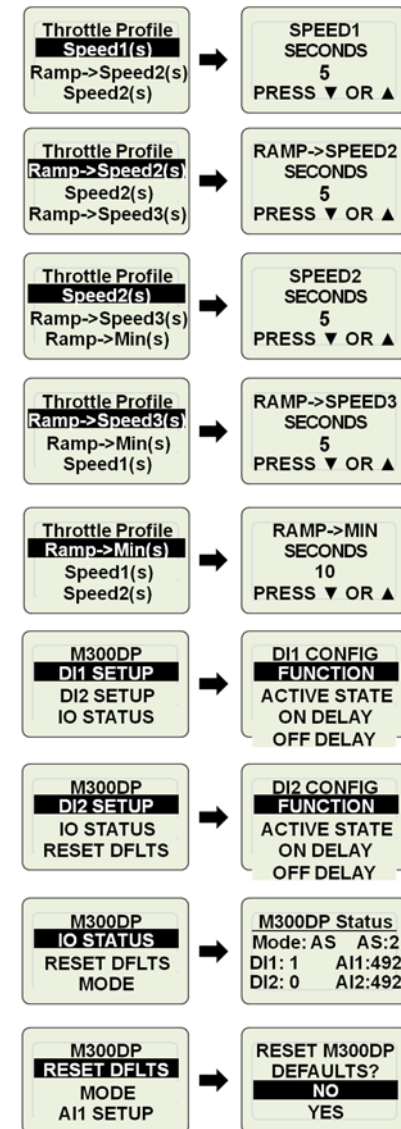


Table 1 - DI1 and DI2 Setup

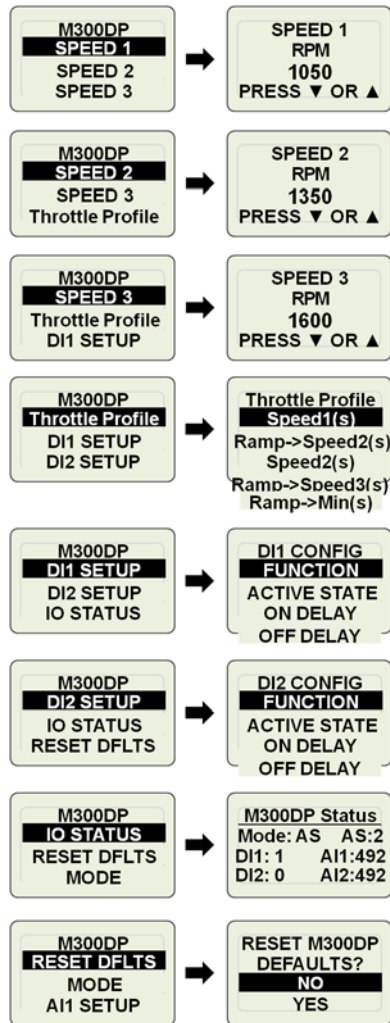
Stop - When configured to Stop, DI1 or DI2 will stop the engine.
Speed 1 - When configured to Speed 1, DI1 or DI2 will ramp the engine to the Speed 1 setting.
Speed 2 - When configured to Speed 2, DI1 or DI2 will ramp the engine to the Speed 2 setting.
Start Inh - When configured to Start Inh (Start Inhibit), the engine will not start while the configured DI is active.
OFF – Disables the discrete input

NOTE: When the DI1 and DI2 inputs are setup as speed inputs, DI2 has priority over DI1 regardless of whether it has been configured to Speed 1 or Speed 2. The throttle switch has priority over both DI1 and DI2.

M300DP Main Menu – con't

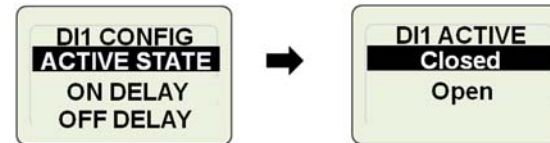


M300DP Main Menu – con't



Active State

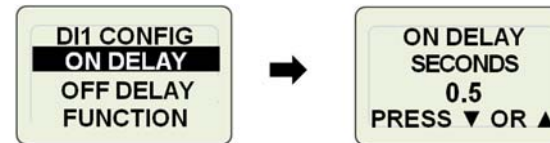
The DI1 and DI2 inputs may be set for an input device that has either a Normally Open (N.O.) or Normally Closed (N.C.) contacts. The active state for a N.O. switch is “Closed” (closure to ground) and the active state of a N.C. switch is “Open”.



Use the “▼” or “▲” keys to highlight desired active state. Press and hold *MODE* key to save selection.

On Delay (s)

The On Delay parameter controls how long (0 to 60.0 seconds) the active state is present before action is taken.



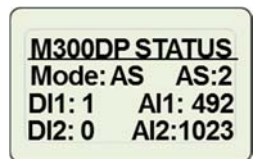
Use the “▼” or “▲” keys to adjust delay time. Press and hold *MODE* key to save changes.

Off Delay (s)

The Off Delay parameter controls how long (0 to 60.0 seconds) the inactive state is present before action is taken.

IO Status

IO Status is a diagnostic screen. The IO Status display provides the Mode, the status of the two digital inputs and the raw ADC counts for the two analog inputs. AS provides the status of the keyswitch: Auto position = 1, On position = 2, Start position = 3.



An Analog input value of 0 indicates the input is shorted. A value of 1023 indicates the input is open.

Auto Start Operation

Auto Start Mode (A/S Mode)

Selecting the A/S Mode allows the DI1 and/or DI2 discrete inputs to start and control the engine. The AI1 and AI2 analog inputs will be also active.

Analog Input Setup

The M300DP Module has two analog inputs which may be configured for a number of senders:

- Off
- Fuel US (240-33 ohms)
- Fuel Euro (10 – 180 ohms)
- Water Level US (240-33 ohms)
- Water Level Euro. (10- 180 ohms)

When the sender has been connected and the setup complete, the sender data will appear on the engine display along with the other engine parameters. Use the “▼” or “▲” keys to highlight the desired sender type. Press and hold *MODE* key to save changes.

Start Retries

The number of engine start cycles to be executed after the initial AutoStart (A/S) sequence is enabled and activated. A start cycle is 10 seconds of cranking followed by a 5 second wait. The number of start retries can be configured for 0 to 3 retries. When configured for 0 retries the engine start cycle will activate one time only, on the initial Auto Start command.

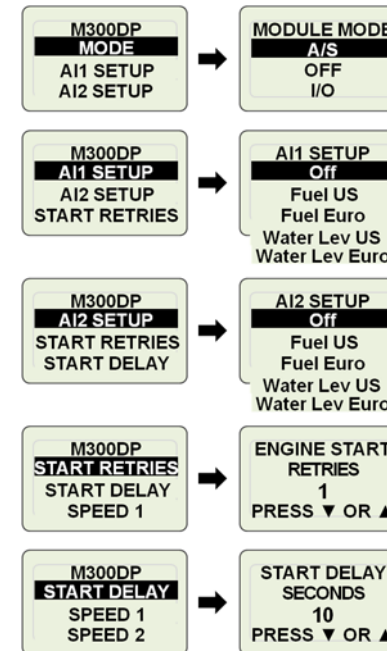
Start Delay(s)

The time (seconds) from the activation of a start input to the time engine cranking begins. This time will appear as a countdown on the display. (0 – 30 seconds). Use the “▼” or “▲” keys to adjust delay. Press and hold *MODE* key to save.



Appendix A - Menu Overview

M300DP Main Menu



Default Settings

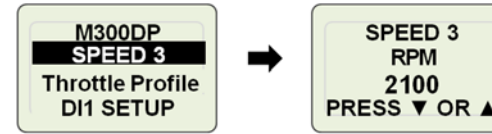
Upon receiving the Auto Start module, the unit will be set to the following values. Setting the module back to defaults is made by using the RESTORE DEFAULTS which is under the ENGINE SETTINGS menu level.

Parameter	Default Value
Display Settings	
M300 Mode	OFF
Speed 1	Engine Min RPM
Speed 2	1500 RPM
Speed 3	Engine Max RPM
Throttle Profile	
Speed1 (s)	5
Speed1 Ramp (s)	5
Speed2 (s)	5
Speed2 Ramp (s)	5
Speed3 (s)	5
Stop (s)	5
DI1 Setup	OFF
DI2 Setup	OFF
AI1	OFF
AI2	OFF
A/S Delay (s)	10
Start Retries	0

Speed Settings

The A/S Mode supports three different engine speed settings. These settings can be used in the throttle profile and in the remote speed assignments. The speed values (RPM) may be programmed from 600 to 3150 in increments of 50 RPMs. Speed 1, 2, and 3 are bounded by the Engine MIN/MAX RPM range in the Engine menu.

(Note: range of rpm settings may vary based on engine model.)



Use the “▼” or “▲” keys to set the RPM for Speed 1, 2, and 3. Press and hold *MODE* key to save each selection.

Throttle Profile

When the AutoStart input is activated, a Throttle Profile is used to control the engine speed over a series of steps. The profile has 5 settings which are described in Table 2 below. Use the “▼” or “▲” keys to set the desired time for each stage of the Throttle Profile. Press and hold *MODE* key to save each selection.

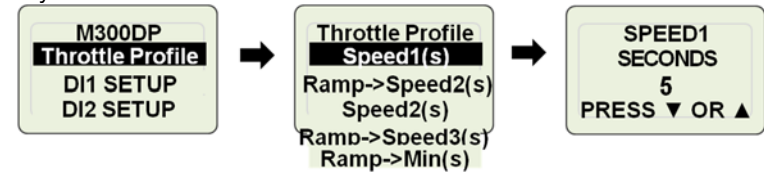


Table 2 - Throttle Profile Setup

Speed1 (s) – This parameter determines how many seconds the engine will run at Speed1.

Ramp->Speed2 (s) – This parameter determines the ramp time from engine Speed 1 to Speed 2 in seconds.

Speed2 (s) – This parameter determines how many seconds the engine will run at Speed2.

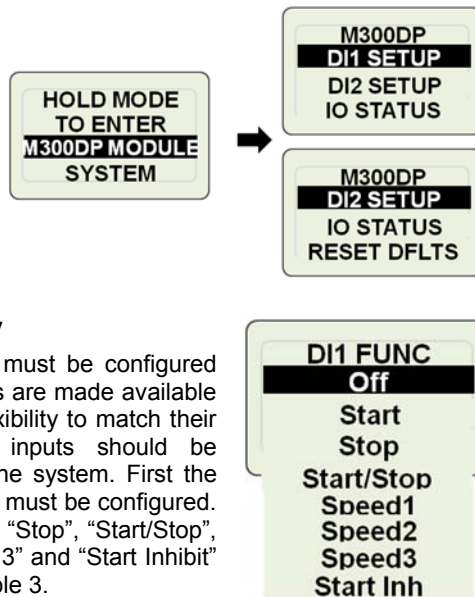
Ramp->Speed3 (s) – This parameter determines the ramp time from engine Speed 2 to Speed 3 in seconds.

Ramp->Min (s) – This parameter determines ramp time from current speed to the Min RPM value in Engine menu.

Note: If a Throttle Profile Segment time is set to zero, that segment of the profile will be skipped.

Digital Input Setup

The DI1 and DI2 Setup Menus are used to program the operation of the two discrete inputs.



Digital Input Functionality

The digital input functionality must be configured and a wide range of selections are made available to the user providing the flexibility to match their specific application. These inputs should be configured before activating the system. First the functionality of the digital input must be configured. The choices are; “Off”, “Start”, “Stop”, “Start/Stop”, “Speed 1”, “Speed 2”, “Speed 3” and “Start Inhibit” (Start Inhibit) as defined in Table 3.

Use the “▼” or “▲” keys to highlight the desired function. Press and hold *MODE* key to save changes.

Table 3. Digital Input Functionality

OFF – Disables the discrete input
Start – When configured to Start, DI1 or DI2 will be used to Start the engine.
Stop - When configured to Stop, DI1 or DI2 will be used to Stop the engine. Note: For safe operation in A/S mode be sure to set one DI to a setting of “Start/Stop” or “Stop”.
Start/Stop - When configured to Start/Stop, DI1 or DI2 will be used to Start the engine when the active state occurs and then Stop the engine when active state goes inactive.
Speed 1 - When configured to Speed 1, DI1 or DI2 will ramp the engine to the Speed 1 setting.
Speed 2 - When configured to Speed 2, DI1 or DI2 will ramp the engine to the Speed 2 setting.
Speed 3 - When configured to Speed 3, DI1 or DI2 will ramp the engine to the Speed 3 setting.
Start Inh - When configured to Start Inh (i.e., Start Inhibit), the engine will not start.

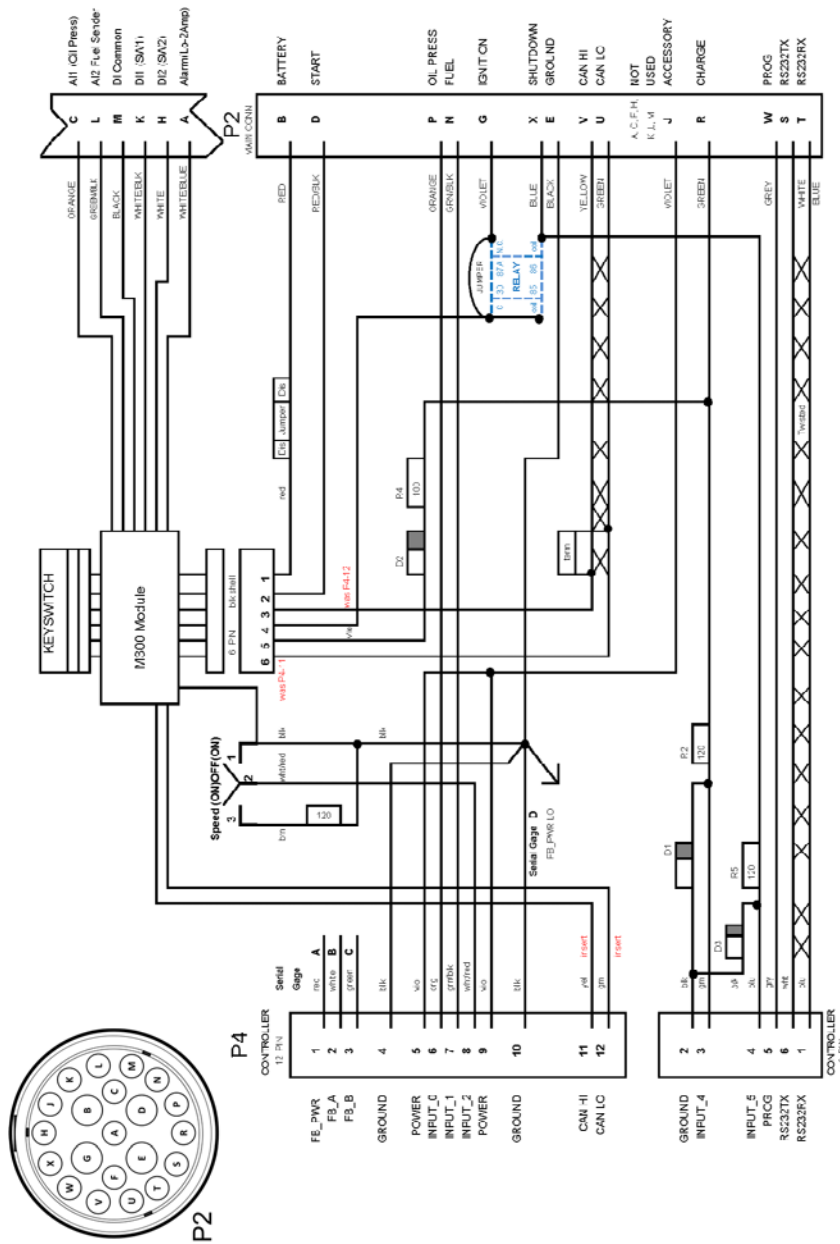
Technical Specifications

Parameter	Specification
Operating Voltage	9 to 32 VDC
Communication	J1939 CAN 2.0B
Operating Temperature	-30C to +70C (-22F to 158F)
Storage Temperature	-40C to +80C (-40F to 176F)
Reverse Polarity Protection	Yes
Salt Spray	IEC60068-2-52: 19960.18 Dia or #8 screw No Tests Performed
EMC	IEC61000 and EN55022 No Tests Performed
Degree of Protection	IP67
Dimensions	102.294mm x 53.39mm x 27.3mm (4.053" x 2.102" x 1.075")
System Protection	Provided externally

System Components

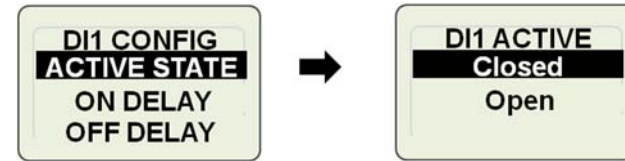
Part Number	Description
M300DP	Expansion I/O Module
/AS	Add M300DP to any M150B or M150L Series product
MN10036	Manual – User M154L Yanmar T4F
MN10047	Manual – M300DP Expansion I/O Control for B Series Panels
MN10058	Manual – M300DP Expansion I/O Control for L Series Panels
MN10060	Data Sheet – M300DP Expansion I/O for L Series Panels

Wiring Diagram



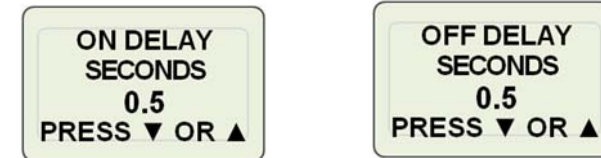
Active State

Each digital input can be configured to determine its active state. This allows the user to set the digital input for an input device that has either a Normally Open (N.O.) contact or a Normally Closed (N.C.) contact. The active state for a N.O. switch should be set to “Closed” (closure to ground) and the active state of a N.C. switch should be set to “Open” (input is open).



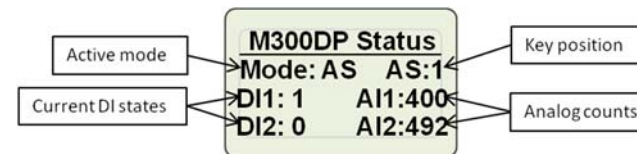
On/Off Delay (s)

The On/Off Delay parameters control how long the active and inactive states must be stable before action is taken. The settable range for these parameters is 0.0 to 60.0 seconds.



IO Status

The IO Status Display is provided for diagnostic purposes. This screen provides information about the status of the M300DP provides the Mode, the status of the DI1 and DI2 inputs and the counts for the AI1 and AI2 inputs. AS provides the status of the keyswitch: Auto =1, On =2, and Start=3



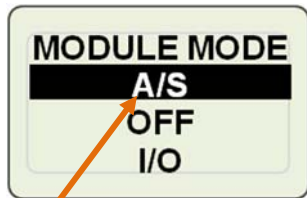
Activating AutoStart

To activate the Auto Start Sequence:

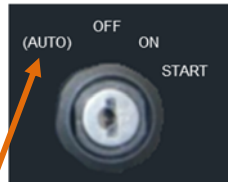
- Enable Auto Start mode
- Configure start and stop DI's and Throttle profile.
- Set the keyswitch is in the "Auto" position
- Activate the DI1 or DI2 inputs configured for Start.

Enable Auto Start Mode

To use the Auto Start feature the M300DP Mode must be set to A/S. See the section on M300 Setup.



Selecting "A/S" enables the AutoStart Mode



Note: A/S is not activated until key switch is in Auto Position.

Set the Keyswitch in the "Auto" Position

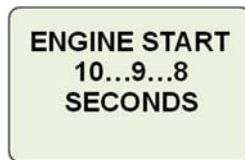
When the ignition switch is placed in the "Auto" position (keyswitch in a fully counter-clockwise position) an ALERT will be displayed on the main engine display. This window will display for approximately 1 minute. The system will then enter a power save mode, waiting for the AutoStart input to activate.



NOTE: If the ignition switch is in the "ON" position the AutoStart feature will not activate.

Activating the AutoStart input

There are two discrete inputs, DI1 and DI2, which may be used to initiate an Auto Start sequence. See the Installation section of this manual for more information.

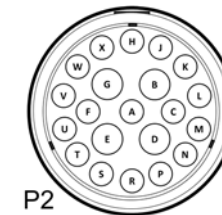


Engine Connector

The engine connector is labeled "Engine" and must be modified to support the Auto Start module. This connector mates directly to the on-engine harness connector.

Table 4. Engine Connector Pin Definitions

Signal	PIN Number	Engine Harness Connector – P2	Contact Size	Wire Color
Alarm	A	M300DP – Alarm (Switch Closure to ground LO-2 Amp Max)	16	White/Blue
B+	B	Battery + (10A)	12	Red
AI1	C	M300DP AI1	16	Orange
Start	D	Starter (30)	12	Red/Black
Ground	E	Ground	12	Black
Ignition Out	G	ECU Power (Ignition)	12	Violet
DI2	H	M300DP DI2	16	White
Controller Power	J	ECU Key On	16	Purple
DI1	K	M300DP DI1	16	White/Blue
AI2	L	M300DP AI2	16	Green/Black
DI Common	M	M300DP DI Common	16	Black
Fuel	N	Fuel Sender	16	Green/Black
Oil Press	P	Oil Press Sender	16	Orange
Charge In	R	Charge Lamp	16	Dark Green
CAN Lo	U	CAN Low (twisted pair)	16	Light Green
CAN Hi	V	CAN High (twisted pair)	16	Yellow
Shutdown	X	External Engine Stop	16	Blue
No Connection	A, F,H,K,L,M, S,T,W			

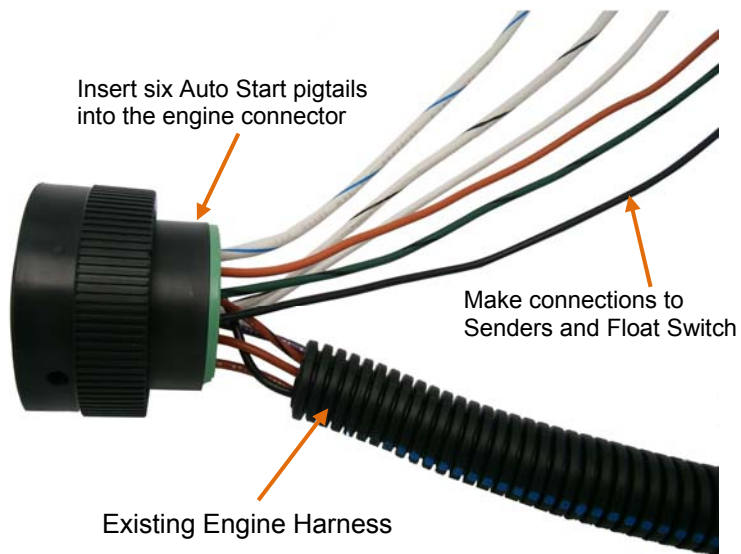


Make External Connections

To connect the two analog inputs and the two discrete inputs to the sender(s), five pigtails are provided and must be inserted into the Engine harness. The recommended pin locations are shown in Table 4.

The installer is responsible for making the connection from each pigtail to the device(s) (Oil Pressure Sender, Fuel Sender, Float Switch, etc.).

Figure 3. Engine Connector Pigtails



When the Auto Start input is activated, the M150L Series will exit the power save mode and indicate an impending engine start sequence by generating a countdown sequence to engine start. If the system has been wired for an alarm, an audible alarm will be heard during this time. See the Installation section of this manual for more information.

CAUTION

Disable Auto Start mode when service is performed on the engine.

Starting the Engine

Once the countdown is complete the module will activate the start input to the engine. The screen will read “ENGINE START NOW” and the starter will remain active for 10 seconds or until the engine is running. If the engine does not successfully start during this time the starter will turn off.

Once Auto Start has been activated the display will switch to the Requested Speed screen and it will reflect the engine speed and ramp times programmed in the Throttle Profile. See the section on setting the Throttle Profile.

ENGINE START
NOW

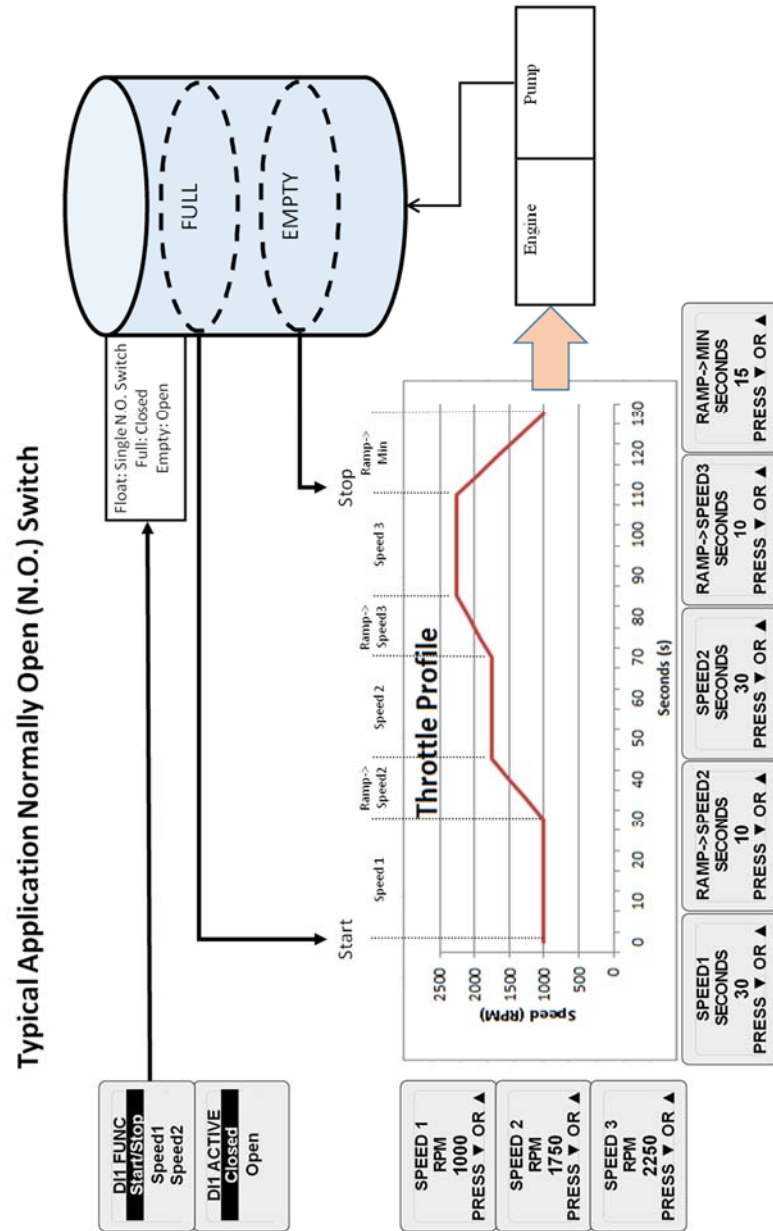
REQUEST RPM
1800_{RPM}
FUEL

Auto Start Failure

If the engine fails to start after the initial 10 seconds and the configured retries, the display will show the “Autostart Failed” screen. At this point the operator will need to cycle the key switch before the M300DP module will attempt to start the engine again.

ALERT
AUTOSTART
FAILED

Typical Auto Start Application



Installing Control Panel with Expansion I/O

⚠ CAUTION

The safety messages that follow have CAUTION level hazards.

ALWAYS ensure the power supply is OFF and battery cables are disconnected before you make any electrical connections

Making the Connections

The control panel has one round connector with 21 contacts. This connector is an HDP24 Deutsch connector and provides the connection to the engine connector. (Note: Some engines may require an interface harness for this connection. Contact MBW Technical Support Team for details.) The supply power MUST be OFF when interconnecting the system.

Recommended order:

1. Verify the battery / battery switch connections to engine per the engine installation diagram. (Refer to engine manufacturer installation manual.) Verify engine is bonded to battery return (-). Verify engine block is connected to battery ground.
2. Disconnect battery.
3. Make external connections to DI1, DI2, AI1, and AI2.
4. Install control panel into the housing. Attach engine connector to housing using supplied locknut and ring.
5. Fasten control panel to housing using #8 8-32 screws (not supplied).
6. Connect engine harness connector to mating control panel connector (HDP24-21 connector).
7. Connect battery.
8. Turn ignition key to "ON" position.
9. Ensure digital display is active. If display is not active;
 - a. Check battery and power connections.
 - b. Check ignition switch is on position.
10. Ensure system is displaying data for engine speed, oil pressure and temperature.