

**MSS-200**

**PROGRAMMING MANUAL**



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## THE MSS-200

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Versatile and incredibly compact, the MSS-200 automatic engine start stop controller is used primarily on stationary equipment, i.e. power generators, compressors and pumping systems. The highly flexible MSS-200 is fully programmable. Its 15 parameters are pre-programmed at the factory to the most commonly used parameters. Changing the factory preset, however, is easily accomplished by pushing three buttons on the front of the unit.

When used in combination with ground contact switches, the MSS-200 can also shutdown the engine due to a failure, i.e., oil pressure, temperature, alternator charge, v-belt or any other customer-defined parameter.

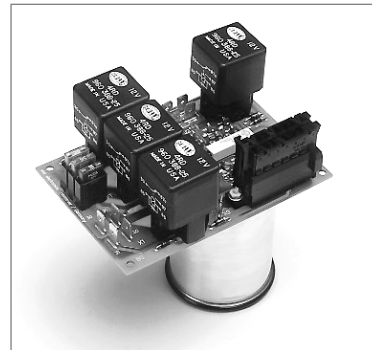
### Specifications

- 12 & 24 volt operation
- Durable IP 63 spray-resistant housing
- Installs into 2-1/16" Panel Opening
- Overall length: 3-1/4"
- Automatic and manual start modes
- Customer programmable
- Ground controlled outputs with maximum amperage capacity of 2A without relays
- Standby amperage draw
  - Zero mA in (+) control mode
  - 40 mA in (-) control mode
- Operating temperature -22 °F - 185 °F
- Flasher/audible alarm output
- Low cost and ease of installation
- Programming instructions provided with each unit

## Options

The MSS-200 relay interface is an optional add on component for the MSS-200 automatic start stop module. This system was developed to reduce wiring, simplify installation, and add more flexibility to the auto start system. This unique circuit board plugs directly onto the backside of the MSS-200 and converts the 2A ground outputs of the MSS-200 to 30A battery positive current. This circuit board can be equipped with up to four relays that can control starter motor engagement, engine run solenoid, G/S switch, Preheat, over-speed shut down. Originally designed for the pumping industry, the relay interface is also equipped with a float switch activation relay which enables an engine to start and stop on demand by means of two normally open floats.

Applications requiring warm-up and cool-down cycle can utilize LOFA's actuator speed control system. This heavy duty actuator is available in 2, 4, and 6 inch stroke, can be easily installed to the MSS-200's G/S switch output. This actuator ideal for turbo charged engine and can slowly adjust the engines RPM to the equipment's specific requirement.



MSS-200 Relay Interface



Actuator

## **WARNING: READ CAREFULLY PRIOR TO INSTALLATION**

An auto start system on an internal combustion engine can potentially cause serious bodily harm. Make sure engine and equipment have the appropriate protective shields and that warning decals are placed in an open and highly visible location.

When installing any automatic start system, implement the following safety precautions.

(1) Disconnect the battery's ground wire prior to any installation or service to prevent the engine from automatically starting.

(2) Install warning decals in an open and highly visible location. Each LOFA panel is equipped with two safety decals one of which is affixed directly to the panel. Should extra decals be required, please contact LOFA Industries, Inc. or send an e-mail to [safety@LOFA.net](mailto:safety@LOFA.net). Free decals are available and limited to 2 decals per panel.

(3) For additional safety Install LOFA's optional Safety Kit (part # 010-0020-00) onto protective shields of engine and equipment. This kit consists of qty. 2 normally open switches which will prevent the engine from running if any protective guard on the engine or equipment is removed.

Addition safety switches may be required to fully protect against safety hazards. Contact LOFA Industries, Inc. for technical assistance in selecting a safety kit that will meet your specific application.

(4) For further safety install LOFA's optional pre-start Alarm Kit (part # 010-1002-00). The Alarm Kit installs to the MSS-200's preheat output and can be programmed to sound an alarm prior to engine start.

(5) Under no circumstance should the MSS-200 automatic engine start system be installed into a mobile vehicle that has a manual transmission.

(6) A 1N4007 diode must be used when using any of LOFA's products to suppress a potential high voltage spike. Install diode as close as possible to the solenoid to prevent high voltage spikes (up to 1000V or more which can occur momentarily when a relay or solenoid is switched off). Relay contacts, electronics, etc., can be damaged, or malfunctions can occur if these spikes reach the electrical network without suppression. Refer to diode installation sheet supplied with each product for installation instructions.

Every electronic product from LOFA is supplied with qty. 2 diodes. Please note installing the diode incorrectly or reversing the battery's polarity will damage the diodes.

(7) The LOFA Industries, Inc. warranty does not cover consequential damages.

Applications that could cause consequential damages if the engine failed to start or if the engine were to shut down should implement a backup system, i.e., backup engine or generator, auto dialer, satellite/cell phone monitoring system.

## BASIC PROGRAMMING INFORMATION

Each MSS-200 is factory programmed to the most commonly used values, but can be easily changed by the customer or by LOFA Industries. The following information is required for programming the MSS-200.

- Number of pole pairs, or if used with a proximity switch, number of pulses per revolution
- Belt ratio (pulley diameter. =  $D1 \div D2$ )  
D1= Crank Shaft Pulley  
D2 = Alternator Pulley
- Rated engine speed RPM (if required)
- Over-speed shutdown RPM (if required)

### Hertz Calculation Formula

In order to program hertz in parameters 18, 20, 22, 24 and 26, you will be required to enter the above information specific to your engine into the following hertz calculation formula. Refer to this formula when programming hertz.

$$\frac{\# \text{ Poles} \times \text{RPM} \times \text{Belt Ratio}}{60 \text{ Seconds}} = \text{Hertz}$$

### Programming Mode

Programming mode is accomplished by holding down the OFF/SET button on the MSS-200 for 2 seconds while energizing the controller. On some LOFA panels equipped with auto start, energizing the MSS-200 is accomplished by turning the key switch to the left position marked auto start. Releasing the OFF/SET button will bring you to parameter #0 "PRE-HEAT DURATION" indicated by the

blinking #1 LED. Pushing the OFF/SET button moves to each parameter in ascending order and saves the programmed value. The MAN button decreases while the AUTO button increases the programmed value.

### Basic Operations

The MSS-200 can be controlled directly from the dial of the MSS-200 by simply pushing either AUTO, MAN and OFF/SET. Only when the MSS-200 is powered up and parameter 30 is programmed to consume electricity will the AUTO and MAN buttons control the engine. Pressing the MAN button manually starts the engine. Engine will continue to run until the OFF/SET button is pressed again or until the power is turned off. If parameter 10 is programmed with a cool down cycle, pressing the OFF/SET button once will start the cool-down period. Pressing the OFF/SET button again will override the cool-down cycle and the engine will shut down immediately. Pressing the AUTO button will cause the AUTO LED to light up, indicating that the engine is in standby mode. If AUTO LED is not lit the engine will not start automatically. Note: A blinking AUTO LED during power-up indicates that the auto start input was activated and prevents the engine from starting.

### Preheat #0

The duration period of the preheat can be programmed by time (in 4 sec. increments) or by ambient temperature if used in combination with a PT-1000 thermistor.

The preheat by time setting has priority over ambient temperature. In case of a defective thermistor or loose wire connection, it is important that a time value is always programmed when used in combination with a thermistor. When using the temperature thermistor provision, use the following table for temperature verses time comparison.

C°	F°	Preheat	After-Glow
+50	122	0 sec	0 sec
+40	104	4 sec	4 sec
+20	68	6 sec	4 sec
0	32	12 sec	6 sec
-20	-4	22 sec	6 sec
-40	-40	30 sec	6 sec

The preheat function on the MSS-200 can also be used in combination with a pre-start audible alarm. Simply program a preheat duration and add an alarm to the preheat output to provide additional safety to your equipment. Alarms are available as an option from LOFA Industries, Inc.

### Repeated Engine Starts #2

If the engine does not start on the first auto start attempt, the engine will go into repeat start mode. The MSS-200 can be programmed to make a maximum of 15 new engine start attempts. During repeated starts the bottom left LED will blink, indicating that the system is in repeated start mode. Note: Engine will not go into repeated start mode if the engine is started manually by pressing the "MAN" button.

### Pause Between Repeated Engine Start #4

Pause between repeated engine start is the period between each repeated start-up attempt. The range for this pause is 5 - 75 seconds in 5 second increments.

### Over-Crank #6

Over-crank the maximum time, in seconds, that the starter motor can be engaged if the engine fails to receive a frequency via the alternator's frequency terminal or proximity switch pick-up. The over-crank feature eliminates the need for any manual settings of starter motor duration usually required for low temperature conditions.

### G/S Generator Load Switch Delay #8

This parameter is primarily used on generator sets and provides the ability to delay G/S switch disengagement normally used to shut off the main electricity-producing generator. With this programmable feature, the generator set will continue to produce AC power from 0-75 seconds after full power is restored, eliminating power interruptions should power turn on and off.

### Engine Cool-down Cycle #10

This parameter controls the length of time in which the engine is in its cooling-down cycle. Once the ground contact is removed from the AUTO terminal wire, the MSS-200 will shut off the G/S Switch, i.e., generator set, air compressor, or throttle control. The engine will run without load for an amount of time established by the customer. Cool-

down cycle time can be programmed from 0 to 900 seconds in 60 second increments. Note: Cool-down cycle can only be used when the controller's standby mode (parameter #30) is programmed to consume electricity.

**Oil Pressure Switch #12**

This parameter is used to select the type of oil pressure switch being used on the engine, i.e., Normally Close, Normally Open or No Oil Pressure Switch. The "No Oil Pressure Switch" setting must be selected when the MSS-200 is used in combination with any other auxiliary engine monitoring and shutdown system, i.e., EP-100, MC-536 or MC-6K. In the solo mode the MSS-200 can also be programmed to monitor oil pressure. This feature adds starter motor protection by preventing the starter motor from engaging when the engine has oil pressure, or if the pressure switch wire has been disconnected. Applications requiring shutdown for other critical functions like high temperature or pump pressure can connect the switch wires to the oil pressure input. Note: Making a small jumper wire from the O/S terminal to Oel (oil) terminal eliminates the need for adding an extra relay for over-speed shutdown.

**Oil Pressure Switch Delay #14**

With this parameter a delay of 1 to 15 seconds can be programmed for oil pressure switch override. This feature gives the engine a certain amount of time to build up oil pressure during engine start prior to monitoring for shutdown. This parameter is required only when the MSS-200 is used in solo mode and when the oil pressure parameter #12 is programmed to either Normally Open or Normally Closed.

**Auxiliary Engine Monitor #16**

This parameter programs the MSS-200 controller to either a stand-alone application (solo) or to an application utilizing an optional engine shut device, i.e., EP-100, MC-536 or MC-6K.

**Duration of Start by Frequency #18**

The MSS-200 will disengage the starter motor when the engine has reached a certain programmed frequency via the frequency terminal of the alternator or proximity PNP pickup. This feature not only disengages the starter motor, but it's also used as a safety feature by preventing the engine from starting when the controller senses RPM. Considering that a starter motor typically disengages at 500 RPM, use the following calculation below using an engine example with a 6 pole pair alternator and a belt ratio of 2.0 :

$$6 \times 500 \times 2.0 \quad 6000$$


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$$\text{-----} = \text{-----} = 100 \text{ Hz}$$

$$60 \text{ Seconds} \quad 60$$

**G/S Frequency-based Load Switch For Generator OR Over-speed Shutdown For Pump #20 (Course)**

Parameters #20, #22, #24 have two functions: G/S frequency-based load switch for constant speed generators applications or over-speed shutdown for variable speed pump applications. The generator switch (G/S) was originally designed to activate an AC-producing generator set, but this output can also used to activate other accessories, i.e., air compressor relief valve or throttle control.

**EXAMPLE:** 1800 RPM G/S Engagement

$$\frac{6 \times 1800 \times 2.0}{60 \text{ Seconds}} = \frac{21600}{60} = 360 \text{ Hz}$$

For parameter #20 select the next smaller number calculated. In our example we calculated 360 Hz. The next smaller number on the programming table is 240 Hz. Press the AUTO button until the LED pattern matches the 240 Hz value. Pressing the SET button saves the programmed value and moves you to parameter #22.

**G/S Frequency-based Load Switch For Generator OR Over-speed Shutdown For Pump #22 (Medium)**

In step #2 subtract the number entered in step #1 from the total frequency calculated.

Example:  $360 - 240 = 120$  (Balance)

Divide the balance by the multiplier 16. Since you can not use a fraction use the next smaller number (7) and multiply by the multiplier (16) which in this example is 112 hz. With this example select the LED pattern that matches 112 Hz.

$$\frac{120}{16} = 7.5 \quad 7 \times 16 = 112 \text{ Hz}$$

**G/S Frequency-based Load Switch For Generator OR Over-speed Shutdown For Pump #24 (Fine)**

Subtract 360 Hz from the total sums entered in steps 1 and 2. The multiplier for step 3 equals 1 Hz. Parameter #24 would be programmed to 8 Hz.

$$240 \text{ Hz} + 112 \text{ Hz} = 352 \text{ Hz}$$

$$360 \text{ Hz} - 352 \text{ Hz} = 8 \text{ Hz}$$

**Generator Over-speed Frequency OR Variable-speed Pump Mode Selection #26**

This parameter has two functions:

(1) Entering a value greater than zero programs the MSS-200 controller to a constant speed generator mode. The frequency programmed in parameter 26 then becomes the over-speed shutdown frequency. Should generator mode not require over-speed then program #26 to highest over-speed frequency setting available (150 Hz). Use the following 2000 RPM calculation to program over-speed for a constant speed generator application:

**EXAMPLE:** Calculating Over-speed Hz

$$\frac{6 \times 2000 \times 2}{60 \text{ Seconds}} = \frac{24000}{60} = 400 \text{ Hz}$$

Subtract 360 (total Hz of G/S in step #20, 22 and 24) from 400 Hz (Over-speed Hz)  $400 - 360 = 40$  Hz. The multiplier for parameter 26 equals 10. Press the AUTO or MAN buttons until the LED pattern matches the 40 Hz value.



(2) Programming parameter #26 to zero programs the MSS-200 for variable-speed pump application with over-speed. The frequency programmed in parameters 20, 22 and 26 then becomes the RPM at which the engine will shut down. Note: When programmed in pump mode over-speed shutdown delay becomes a fixed zero second delay.

### **Over-speed Shutdown Delay Generator Mode OR Engine Warm-up Duration In Pump Mode #28**

This parameter also has two functions: (1) over-speed shutdown delay when parameter 26 is programmed to constant speed generator mode or (2) engine warm-up duration on a variable-speed pump mode. When the MSS-200 is programmed to generator mode this parameter can delay over-speed shutdown from 0 to 30 seconds. When the application is a variable-speed pump with over-speed this parameter can be used as a warm-up period from 8 to 38 seconds in 2 second increments.

### **Standby Mode #30**

Standby mode on the MSS-200 can be programmed to either to consume electricity or to consume no electricity. In mode that consumes electricity the controller is activated by a ground contact to the AUTO terminal and deactivated when ground from the AUTO terminal is removed. During standby mode the top right "AUTO" LED is lit indicating that the unit is in standby mode. In the standby mode that does not consume electricity the MSS-200 is activated when the unit receives a battery plus signal. When battery positive signal is removed the engine will shut down immediately. Note: Cool-down cycle and manual start

by pushing MAN can not be used in mode that consumes no electricity.

### **Programming End**

Programming mode can be ended at any time simply by removing power from the MSS-200 or by going to the last parameter #30. As long as the OFF/SET button is pressed the last programmed value will be saved in memory.

### **Pass Code**

If the MSS-200 is programmed with a pass code or if you are adding a pass code for the first time, you will then be required to push the AUTO and OFF/SET buttons at the same time while energizing the system. As soon as the two buttons are released the #1 LED blinks indicating #1 pass code location. Note that this LED indication is the same as preheat duration; however since the AUTO and MAN buttons were pushed at the same time this parameter equals pass-code #1. In order to create a new pass code for the first time the factory pass code setting of zero, zero, zero must be entered. *Refer to programming table for more information.*

### **Pass Code #32**

This parameter changes the first of three pass codes (0-15).

### **Pass Code #34**

This parameter changes the second of three pass codes (0-15).

### **Pass Code #36**

This parameter changes the third of three pass codes (0-15).

## PROGRAMMING THE MSS-200

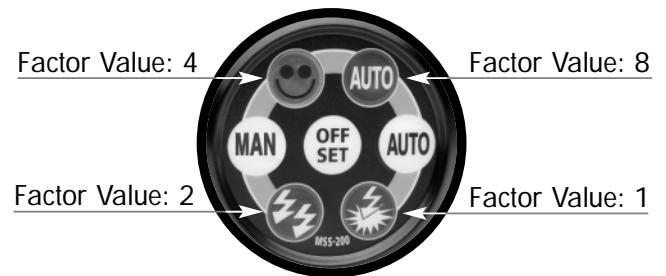
The MSS-200 is a state-of-the-art electronic automatic engine start-stop controller that can be programmed to each customer's unique requirements. The system programs from the outside of the compact cylindrical design using a simple binary code sequence.

The controller has the following 15 programmable parameters:

- Preheat time (0...60 seconds or ambient temperature)
- Number of repeated starts (0...15)
- Pause between repeated starts (5...75 seconds)
- Over Crank (2...30 seconds) or frequency
- G/S Generator load switch shutdown delay (0...75 seconds)
- Engine cool-down cycle (0...900 seconds)
- Oil pressure switch (normally open, normally closed, or without switch)
- Oil pressure delay override (1...15 seconds)
- Auxiliary engine monitor and shutdown system (EP-100, MC-536, or solo)
- Starter motor disengagement by frequency (in Hz)
- G/S frequency-based switch to turn on electric power, air compressor, throttle control, etc. (in Hz)
- Over-speed shutdown (in Hz)
- Over-speed shutdown delay (2...30 seconds)
- Warmup duration (8...38 seconds)
- Standby mode (does/doesn't consume energy)
- Pass code (3 digit 0-15)

The controller contains four (4) LEDs. Each LED, as shown below, has a dual purpose of (1) parameter and (2) value.

	Indicates a flashing LED and identifies the function being programmed
	Indicates an on or lit LED and identifies the value of the function
	Indicates LED is off

















LEDs								
Value	1	2	3	4	5	6	7	8

LEDs								
Value	9	10	11	12	13	14	15	16

## PROGRAMMING GUIDE

Number Of Pushes Of OFF/SET	Button to Push	Parameter	LED Indicator	Multiplier	Factory Setting	Range	To Decrease Value (-)	To Increase Value (+)
	OFF/SET+ Turn key	Turn On System	④ ⑧ ② ①					
0	OFF/SET	Preheat Duration	④ ⑧ ② ①					
	OFF/SET	Input: Time (sec)	④ ⑧ ② ①	4	0 sec	0...60 sec	(-) MAN	(+) AUTO
2	OFF/SET	Repeated Starts	④ ⑧ <del>② ①</del>					
	OFF/SET	Input: Number of	④ ⑧ ② ①	1	3	0...15	(-) MAN	(+) AUTO
4	OFF/SET	Pause Between Starts	④ ⑧ <del>② ①</del>					
	OFF/SET	Input: Time (sec)	④ ⑧ ② ①	5	5 sec	5...75 sec	(-) MAN	(+) AUTO
6	OFF/SET	Over Crank	<del>④ ⑧</del> ② ①					
	OFF/SET	Input: Time (sec)	④ ⑧ ② ①	2	10 sec	2...30 sec	(-) MAN	(+) AUTO
8	OFF/SET	G/S Load Switch Delay	<del>④ ⑧</del> ② ①					
	OFF/SET	Input: Time (sec)	④ ⑧ ② ①	5	0 sec	0...75 sec	(-) MAN	(+) AUTO
10	OFF/SET	Engine Cool-down Cycle	<del>④ ⑧</del> <del>② ①</del>					
	OFF/SET	Input: Time (sec)	④ ⑧ ② ①	60	0 sec	0...900 sec	(-) MAN	(+) AUTO
12	OFF/SET	Oil Pressure Switch	<del>④ ⑧</del> <del>② ①</del>				(-) MAN	(+) AUTO
	OFF/SET	Input: Type	④ ⑧ ② ①	none	none	0-1-2	(-) MAN	(+) AUTO
	OFF/SET		④ ⑧ ② ①	Normally Closed (NC)		0-1-2	(-) MAN	(+) AUTO
	OFF/SET		④ ⑧ ② ①	Normally Open (NO)		0-1-2	(-) MAN	(+) AUTO

## PROGRAMMING GUIDE

Number Of Pushes Of OFF/SET	Button to Push	Parameter	LED Indicator	Multiplier	Factory Setting	Range	To Decrease Value (-)	To Increase Value (+)
14	OFF/SET	Oil Pressure Delay						
	OFF/SET	Input: Time (sec)		1	8 sec		(-) MAN	(+) AUTO
16	OFF/SET	Aux. Engine Monitoring						
	OFF/SET	Solo				0-1		
	OFF/SET	Opt. Engine Monitoring Device			Optional Device	0-1	(-) MAN	(+) AUTO
18	OFF/SET	Duration Of Start By Frequency (Alt./ Pickup)						
	OFF/SET	Input: Frequency (Hz)		16	96 Hz	1...240 Hz	(-) MAN	(+) AUTO
20 Step #1 Course RPM Setting	OFF/SET	Pump Mode: Over-speed Hz OR Generator Mode: G/S Engagement Hz						
<p>Note: For Over-speed shut down for variable speed pump applications parameter #26 must be programmed to zero "pump mode." In pump mode over-speed shutdown delay is a fixed zero second delay.</p>								
	OFF/SET	Turns On G/S Without Any Frequency			No Frequency Input		(-) MAN	(+) AUTO
	OFF/SET	Input 1: Frequency Continue Input In Section 22, & 24		For Below 240 Hz		0 Hz	(-) MAN	(+) AUTO
	OFF/SET	Input 2: Frequency (Hz)		240 Hz And Above		240 Hz	(-) MAN	(+) AUTO
	OFF/SET	Input 3: Frequency (Hz)		480 Hz And Above		480 Hz	(-) MAN	(+) AUTO
	OFF/SET	Input 4: Frequency (Hz)		780 Hz And Above		720 Hz	(-) MAN	(+) AUTO
	OFF/SET	Input 5: Frequency (Hz)		960 Hz And Above		960 Hz	(-) MAN	(+) AUTO









## PROGRAMMING GUIDE

Number Of Pushes Of OFF/SET	Button to Push	Parameter	LED Indicator	Multiplier	Factory Setting	Range	To Decrease Value (-)	To Increase Value (+)
22 Step #2 Medium RPM Setting	OFF/SET	Pump Mode: Over-speed Hz OR Generator Mode: G/S Engagement Hz	<del>4</del> <del>8</del> <del>2</del> <del>1</del>					
	OFF/SET	Input: Frequency (Hz)	4 8 2 1	16	0 Hz	0...240 Hz	(-) MAN	(+) AUTO
24 Step #3 Fine RPM Setting	OFF/SET	Pump Mode: Over-speed Hz OR Generator Mode: G/S Engagement Hz	<del>4</del> <del>8</del> <del>2</del> <del>1</del>	1	0 Hz			
	OFF/SET	Input: Frequency (Hz)	4 8 2 1	1	0 Hz	0-15 Hz	(-) MAN	(+) AUTO
26	OFF/SET	Pump Mode OR Generator Over-speed Frequency	<del>4</del> <del>8</del> <del>2</del> <del>1</del>					
	OFF/SET	Pump Mode	4 8 2 1		Pump Mode		(-) MAN	(+) AUTO
	OFF/SET	Generator Mode: Over-speed Shutdown Frequency (Hz)	4 8 2 1	10	0 sec	10...150 Hz	(-) MAN	(+) AUTO
28	OFF/SET	Pump Mode Warm-up Period In Sec. <hr/> Generator Mode Over-speed Shutdown Delay	<del>4</del> <del>8</del> <del>2</del> <del>1</del>	Refer to Parameter #26				
	OFF/SET	Input: Time (sec)	4 8 2 1	2	Pump = 8 sec Gen = 0 sec	8...38 sec 0...30 sec	(-) MAN (-) MAN	(+) AUTO (+) AUTO
30	OFF/SET	Standby Mode	<del>4</del> <del>8</del> <del>2</del> <del>1</del>					
	OFF/SET	[Consumes NO electricity] Immediate Start With + Current	4 8 2 1				(-) MAN	(+) AUTO
	OFF/SET	[Consumes electricity]	4 8 2 1	Manual or automatic start when system is grounded			(-) MAN	(+) AUTO







## ENTERING A PASS CODE

The MSS-200 allows the user to input a 3-digit pass code to prevent unauthorized personnel from changing any of the controller's parameters. This pass code is factory-set to 0,0,0. However, the factory set pass code does NOT prevent unauthorized individuals from changing any of the controller's parameters. Entering a user-defined pass code for the first time requires first entering the factory-set pass code. In order to enter a user-defined pass code, one must first push and hold the OFF/SET and AUTO buttons simultaneously while energizing the









system. One LED will blink indicating the first pass code. Press the OFF/SET button and select the first pass code value (0-15) using the AUTO and HAND buttons. Repeat this procedure until all 3 pass code numbers are entered. Once all three numbers are entered, value number 1 LED will blink indicating PREHEAT. From this point press the OFF/SET button 32 times and perform the procedure shown to the right to change the pass code. NOTE: There is no way for a customer to override the pass code, so write down your pass code and keep it in a safe place.

Number Of Pushes Of OFF/SET	Button to Push	Parameter	LED Indicator	Multiplier	Factory Setting	Range	To Decrease Value (-)	To Increase Value (+)
	OFF/SET and AUTO	Turn on System						
0	OFF/SET	Pass Code						
	OFF/SET	Input: First Value		1	0	0...15	(-) MANUAL	(+) AUTO
1	OFF/SET	Pass Code						
	OFF/SET	Input: Second Value		1	0	0...15	(-) MANUAL	(+) AUTO
3	OFF/SET	Pass Code						
	OFF/SET	Input: Third Value		1	0	0...15	(-) MANUAL	(+) AUTO
0	OFF/SET	Preheat: Continue with Programming Guide No. 0						

## ENTERING A PASS CODE

Number Of Pushes Of OFF/SET	Button To Push	Parameter	LED Indicator	Multiplier	Factory Setting	Range	To Decrease Value (-)	To Increase Value (+)
32	OFF/SET	Pass code						
	OFF/SET	Input: First Value		1	0	0...15	(-) MANUAL	(+) AUTO
34	OFF/SET	Pass code						
	OFF/SET	Input: Second Value		1	0	0...15	(-) MANUAL	(+) AUTO
36	OFF/SET	Pass code						
	OFF/SET	Input: Third Value		1	0	0...15	(-) MANUAL	(+) AUTO

## LED INDICATION

LEDs	LED Explanation While MSS-200 Is In AUTO Mode
	Automatic self-test. The MSS-200 is turned on (System Energized).
	MSS-200 is awaiting start signal via ground (Switch contact is open). Changing to manual start mode is possible by pressing the OFF/SET and then the HAND button.
	Switch contact was closed while energizing the system. Pushing the AUTO or OFF/SET then Hand button will start the engine.
	Engine is preheating.
	Engine is starting.
	Engine is in repeated start mode.
	Engine is running. The AUTO LED is lit indicating that the engine was started automatically by grounding the AUTO terminal.
	While engine was running the switch contact was closed or the OFF/SET button was pushed one time. Engine is in the cooling-down cycle.

## LED INDICATION

LEDs	LED Explanation While MSS-200 Is In Manual Mode
<del>4</del> <del>8</del> <del>2</del> <del>1</del>	Automatic self-test. The MSS-200 is turned on (System Energized).
4 8 2 1	The MSS-200 is in off position and is awaiting a manual start signal (Pushing HAND button will start engine). Changing to AUTO mode is possible by pressing the AUTO button.
4 8 2 <del>1</del>	Engine is preheating.
4 8 <del>2</del> <del>1</del>	Engine is starting.
4 8 <del>2</del> <del>1</del>	Engine is running via the manual mode. If programmed engine will go into cool-down cycle when the OFF/SET button is pushed 1 time. Engine will stop immediately when OFF/SET button is pushed 2 times.
<del>4</del> <del>8</del> <del>2</del> <del>1</del>	Engine is in cooling-down cycle. Engine will shut down after it runs without a load for the programmed amount of time.

## TROUBLESHOOTING

LEDs	Explanation of Failure
4 8 <del>2</del> <del>1</del>	No oil pressure or over-speed if a jumper wire was made from O/S to Oel.
4 <del>8</del> <del>2</del> <del>1</del>	Defective alternator or pick-up, wire breakage or v-belt breakage. MSS-200 is not receiving a frequency signal.
4 <del>8</del> <del>2</del> <del>1</del>	Engine did not reach the set engine speed within 30 seconds (Relates to G/S frequency in parameters 20, 22, 24, and 26 programmed to generator mode).
<del>4</del> <del>8</del> <del>2</del> <del>1</del>	Possible problem with inputs: electrical short, wire breakage, or defective transistor.
<del>4</del> <del>8</del> <del>2</del> <del>1</del>	Prior to engine start there was a problem with the alternator or oil pressure switch, which is most probably due to an incorrect value programmed into the system.
<del>4</del> <del>8</del> <del>2</del> <del>1</del>	All engine start attempts failed. Check fuel level or fuel filter.











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