

Generator Start/Stop Control Unit



Ref 2389P/Iss1



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1. Introduction

The control philosophy of the P&S panel is based around the well-proven class-approved *Auto Maskin* DCU 305 generator control unit, c/w an operator HMI interface unit fitted to the front panel.

Included with the inbuilt functions is an alarm list on the HMI which gives a list of all connected sensors and whether or not they are in alarm, and an event log is also provided that lists the last 500 events.

2. Technical Description

2.1 Overview

The 'heart' of the unit is the *Auto Maskin* DCU 305 control unit.

This consists of the panel-mounted HMI for operator access/control, the RK66 control unit internal to the panel where the I/O and power supply is terminated and an extension MK14 relay unit. All 3 units are connected together via D-type multi-way connectors.

The *Auto Maskin* unit has been pre-programmed/configured for this project using the *Auto Maskin* – 'Rudolf' configuration tool/software.

As well as providing the functions for generator control, the *Auto Maskin* unit provides a backup system in the event of failure of the *Auto Maskin* microcomputer.

In this event, as well as an alarm being given (*common alarm* relay output) the signals supplied to channels 1 – 6 (i.e. shutdown signals from L.O., CW, etc, including overspeed) will operate the shutdown - the backup is activated if a genuine shutdown occurs, operating both the governor and main shutdown stop solenoid valves.

2.2 Operation and Technical Description

Refer to P&S drawing no's:

2389-E-0127 (External Connections)
2389-E-0129 (Control Panel Items)

Additional Documentation for the *General Operation* of the HMI Panel:

Auto Maskin DC305 User's Manual
Auto Maskin DC305 Installation Manual

24 VDC is applied to the control panel via terminal 1 and 6. In turn, the 24 VDC for the Oil Mist Detector and the governor motor is supplied from the panel, via MCB's MCB3 and MCB2 respectively.

An additional MCB4 is used to isolate the power to the start and stop solenoids.

In the event of power failure, RL13 will operate and provide an alarm out.

The following input channels are used to provide an emergency shutdown for the engine, and are all wire-break monitored:

Oil Mist Detector High
Charge Air Temperature High
CW Temperature High
L.O. Pressure Low
Emergency Shutdown Pushbutton - Remote
Emergency Shutdown Pushbutton – Panel

All of the above are normally-open type contacts, i.e. open when the engine is running normally, and have a 10k ohm resistor connected across the transducer terminals, at the transducer.

(Overspeed is also a shutdown signal, but is generated internally).

Wire-break monitoring is also provided for the emergency stop solenoid valve V303, using the WB1 module. Current is sensed through the coil by measuring the volt drop across a (relatively high value) series resistor and is fed to an input channel on the WB1.

Because the coil resistance is much lower than the resistor value, the voltage generated is small (approx 1.9V), but if the coil goes open-circuit, the voltage will rise up to the resistor supply voltage and cause the WB1 module to trip, and operate RL4, which in turn sets off a wire-break alarm. This will also be indicated on the HMI.

2.2.1 Engine Stopped/Initial Conditions

Power up Unit

Press horn silence/accept if necessary at the HMI.

Ensure all start interlocks are off:

Local/Remote to remote (on engine)
Pre L.O. pressure OK
Turning Gear out
External start block off

Initial Conditions on HMI:

Standby light ON
Power ON
Battery Voltage Indicator reading
RPM reads 0 RPM
Start Fuel Limit ON

(Panel Internal):

No lights or relays operated on MK14 relay unit

Relay K5 - *common alarm* (energised – normal)
Relay K8 - *ready to start* (energised)

Relays RL6, 7, 8, 12, 13 energised

Alarm Conditions at Panel:

All safe (short circuit)

Overspeed	s/c
Broken wire	s/c
Blocking of pressure alarms	s/c
Tacho failure/start failure	s/c
Emergency stop signal on	s/c
Power fail alarm	s/c
Pre-Lub pressure	s/c
Common Alarm	s/c

PMS Conditions at Panel:

Ready to start	s/c
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Local/remote o/c
Tacho failure/start failure s/c
Engine running o/c
Any stop signal on o/c
Emergency stop signal on o/c

Pre Lub oil pump Condition at Panel s/c

Engine:

All solenoids de-energised except start fuel-limit

2.2.2 Engine Start (from HMI)

Press and hold down the *Auto Maskin Start* Button on the HMI.

The start air solenoid will operate and the engine will turn over. Once speed picks up on fuel, release the start button on the HMI.

The engine will run up to speed, and note the following;

Control of pre-lub pump signal comes off at 300 RPM
Engine running signal to PMS comes on at 400 RPM
Start fuel limiter signal comes off at 400 RPM
The hours counter will start operating 400 RPM
Blocking of pressure alarms will come off at 500 RPM

The engine speed will be displayed on the HMI (with a 'red line' for the overspeed setting showing).

Note: the remote start from the PMS will also be required to maintain the 'on' state until the engine has started – see section 2.2.3. for further info on *remote* start operation/characteristics.

2.2.3 Engine Start (from PMS)

Starting the engine remotely will cause the engine to run up in the same way as above, i.e. when starting 'manually' from the HMI in the start/stop control panel.

However, the difference is in the failure to start mode.

If the engine fails to get up to speed in a given time, the start will automatically be halted and then attempt a restart automatically. There will be 3 start attempts, with a cranking time of 7 seconds and a 7 second delay between start attempts.

2.2.4 Engine Running

Whilst the engine is running the Hi/Lo solenoid valve V302 will operate in accordance with the Hi/Lo load pressure switch P602.

The turbo charger RPM signal from the 2 wire inductive pick up is fed to a pulse to voltage converter CONV2. Here the signal is converted to a 0-10 VDC signal (30,000 rpm \equiv 3,000Hz \equiv 10 VDC) for driving the external meter on the engine and another external meter if required (via terminals 98 and 99).

The engine RPM signal from the 2 wire inductive pick up is fed directly to the Auto Maskin unit – RK66. CONV2. This signal is used for control purposes.

The engine RPM signal from the 3 wire proximity type pick up is fed to a pulse to voltage converter CONV1. Here the signal is converted to a 0-10 VDC signal (1,000 rpm \equiv 417Hz \equiv 10 VDC) for driving the external meter on the engine and another external meter if required (via isolating buffer amplifier CONV3 and terminals 96 and 97).

2.2.5 Emergency Shutdowns

Whilst the engine is running and any of the following emergency shutdowns are operated,

Oil Mist Detector High
Charge Air Temperature High
CW Temperature High
L.O. Pressure Low
Emergency Shutdown Pushbutton - Remote
Emergency Shutdown Pushbutton – Panel
Overspeed (via internally generated signal)

The following sequence will occur;

Governor stop solenoid valve will operate
Shutdown solenoid valve will operate
Alarm will sound on the HMI
Shutdown lights
Stop lights
HMI advises 'stopping'
HMI will advise which shutdown occurred

Press silence and then accept on the HMI.

2.2.6 Engine Stop

To stop the engine, momentarily press the stop button on the HMI.

The governor stop solenoid will be operated and the engine will slow down and stop.

The solenoid will be held on until the engine has in fact stopped.

Note: the HMI stop signal will have the same effect as the remote stop from the PMS and works immediately.

2.2.7 Local Control – External Engine Switch

With engine stopped, select local control on the engine.

At the control panel/HMI, the following conditions/states will prevail;

Local Control at engine shows on HMI
Start on HMI is blocked
Standby changes to Local
Standby green LED goes out
Warning LED comes on.

No start will be allowed in these conditions, either from the HMI pushbutton or via a remote start input.

2.2.8 Local Control – ‘Local’ Selected on HMI

With engine stopped, press and hold ‘INFO’ switch on HMI for 2 seconds. Then press and hold horn silence for 2 seconds.

Local control will now show on the HMI.

In these conditions, start and stop are only available via the HMI. No external resets or start/stops will function.

Reverse the above sequence to go back to ‘normal’, .e.

INFO for 2 seconds
Silence for 2 seconds

2.2.9 Local Control – ‘Local’ Selected on HMI

With engine stopped, press standby button on HMI (‘toggle’ type action) – green LED will go out and standby will change to manual on the bottom info bar.

Start cannot now be made (automatic) but can be made via the green start button on the HMI.

In other words this is the ‘normal’ LOCAL mode of operation of the *Auto Maskin* with no START input available from the PMS, although note an external STOP demand will still function.