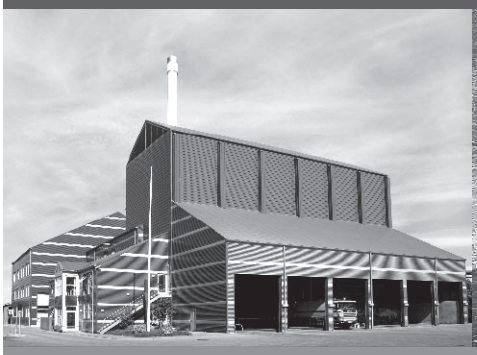
MULTI-LINE 2
DESCRIPTION OF OPTIONS



Option H6
Cummins GCS communication

- Description of option
- Functional description
- Modbus communication

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1. Delimitation

1.1 Scope of option H6

This description of options covers the following products:

AGC-3	SW version 3.4x.x or later
AGC-4	SW version 4.0x.x or later
GPC	SW version 3.0x.x or later
GPU/PPU	SW version 3.0x.x or later

2. General information

2.1 Warnings, legal information and safety

2.1.1 Warnings and notes

Throughout this document, a number of warnings and notes with helpful user information will be presented. To ensure that these are noticed, they will be highlighted as follows in order to separate them from the general text.

Warnings

Warnings indicate a potentially dangerous situation, which could result in death, personal injury or damaged equipment, if certain guidelines are not followed.

Notes

Notes provide general information, which will be helpful for the reader to bear in mind.

2.1.2 Legal information and disclaimer

DEIF takes no responsibility for installation or operation of the generator set. If there is any doubt about how to install or operate the engine/generator controlled by the Multi-line 2 unit, the company responsible for the installation or the operation of the set must be contacted.

The Multi-line 2 unit is not to be opened by unauthorised personnel. If opened anyway, the warranty will be lost.

Disclaimer

DEIF A/S reserves the right to change any of the contents of this document without prior notice.

The English version of this document always contains the most recent and up-to-date information about the product. DEIF does not take responsibility for the accuracy of translations, and translations might not be updated at the same time as the English document. If there is a discrepancy, the English version prevails.

2.1.3 Safety issues

Installing and operating the Multi-line 2 unit may imply work with dangerous currents and voltages. Therefore, the installation should only be carried out by authorised personnel who understand the risks involved in working with live electrical equipment.

Be aware of the hazardous live currents and voltages. Do not touch any AC measurement inputs as this could lead to injury or death.

2.1.4 Electrostatic discharge awareness

Sufficient care must be taken to protect the terminals against static discharges during the installation. Once the unit is installed and connected, these precautions are no longer necessary.

2.1.5 Factory settings

The Multi-line 2 unit is delivered from factory with certain factory settings. These are based on average values and are not necessarily the correct settings for matching the engine/generator set in question. Precautions must be taken to check the settings before running the engine/generator set.

3. Description of option - AGC, PPU, GPU, GPC

3.1 Option H6

Option H6 is a hardware option, and therefore a separate PCB is installed in slot #8 in addition to the standard-installed hardware.

3.2 Terminal description

3.2.1 Engine side Modbus connections

The PCB for the ECM communication module is placed in slot #8.

Term.	Function	Description
133	DATA + (A)	Modbus RTU, RS-485, Cummins Engine Interface Communication
132	GND	
131	DATA - (B)	
130	Not used	
129	DATA + (A)	
128	Not used	
127	DATA - (B)	
126	Not used	

Terminals 129 and 133 are internally connected.
Terminals 127 and 131 are internally connected.

3.2.2 External Modbus connections

The PCB for the Modbus card is placed in slot #2 if the controller unit is equipped with option H2 (Modbus).

Term.	Function	Description
29	DATA + (A)	Modbus RTU, RS-485
30	GND	
31	DATA - (B)	
32	Not used	
33	DATA + (A)	
34	Not used	
35	DATA - (B)	
36	Not used	

Terminals 29 and 33 are internally connected.
Terminals 31 and 35 are internally connected.

Only Modbus can be used to transmit the data to the PLC. Profibus cannot be used.

3.3 Wirings

For wiring details, refer to the Installation instructions.

4. Functional description

4.1 Cummins GCS communication

This communication extracts information from the Electronic Control Module (ECM) of a Cummins engine equipped with the ECM module. The values can be used as display values, alarms/shutdown alarms and values to be transmitted through Modbus.

4.2 Engine type

The Cummins Engine Interface Communication (EIC) supports two protocols depending on the Generator drive Control System (GCS).

It is possible to read data from the engine types QSX15, QSK23, QSK45, QSK60, QSK78 and QST30. The specific engine type can be set up via the display or via the PC utility software.

The PC utility software (USW) can be downloaded free of charge at www.deif.com.

4.3 Communication system

The Cummins protocol is based on a Modbus system in which the controller unit is the master unit. The Baud rate is fixed by Cummins at 9600 Baud. The Cummins GCS (Generator drive Control System) has a fixed slave address (that is, ID) at 01. The Baud rate and ID cannot be changed in the controller.

Refer to the Cummins user manuals for more information about the technical description and details of the Cummins protocol.

4.3.1 Setting up communication

It is possible to communicate to a Cummins ECU via Modbus and to a DAVR via CAN bus simultaneously if both option H5.2 and H6 are present.

The following examples show an overview of some of the combinations:

Description of setup:	Settings:
AVR: Analogue GOV: Modbus master-based ECU (option H6)	● 2781 (Regulator output GOV): EIC ● 2783 (Regulator output AVR): Analogue ● 7561 (Engine interface): Cummins ● 7843 (CAN bus port C protocol): EIC
GOV: Modbus master-based ECU (option H6) AVR: DVC 310 (option H5)	● 2781 (Regulator output GOV): EIC ● 2783 (Regulator output AVR): EIC ● 7561 (Engine interface): Cummins QSX/QSK/QST ● 7565 (Digital AVR interface): DEIF DVC 310 ● 7843 (CAN bus port C protocol): Ext. modules DEIF

In the examples above, option H6 is mounted in slot #8 and option H5 in slot #2. Option H5 can be replaced by option H12. The parameters regarding the specific CAN port setup must then be changed so they fit the application.

4.4 Alarm

A number of alarms can be configured. Refer to the Designer's reference handbook for information about this configuration.

The following items can be configured to an alarm:

Menu number	Alarm	Comment
7570	EIC error	
7580	EIC warning	Corresponds to the Cummins bit data "Common warning lamp/driver command"
7590	EIC shutdown	Corresponds to the Cummins bit data "Common shutdown lamp/driver command"
7600	EIC overspeed	Actual RPM
7610/7620	EIC coolant t. (2 levels)	Actual temperature
7630/7640	EIC oil press. (2 levels)	Actual pressure

Note that the number of configurable relay outputs is option-dependent if the alarm must activate a relay output.

4.5 Displayed values

The tables below show the messages/values that can be displayed in the view menu.

For information about the menu structure of the ML-2 unit, see the Designer's reference handbook.

The display values corresponding to the engine communication have a description beginning with "EIC".

4.5.1 Error messages

The following error messages can occur:

Message	Description
Engine I. value N.A.	The value is not available for the present engine type
Value selected error	The value cannot be read due to sensor error, sub-system or module error
"N.A."	The available value changes to N.A. due to communication error

4.5.2 Object selection

The view lines can be configured with the available values:

Object	Cummins QSX15	Cummins QSK23/ QSK45/QSK60/ QSK78	Cummins QST30
EIC Engine speed	Available	Available	Available
EIC Engine coolant temperature	Available	Available	Available
EIC Engine oil pressure	Available	Available	Available
EIC Battery voltage	Available	Available	Available
EIC Engine oil temperature	Available	-	Available
EIC Air inlet temperature (Intake manifold temperature)	Available	Available	Available
EIC Fuel rate (Consumption rate)	Available	Available	Available
EIC Air inlet pressure (Intake manifold pressure)	Available	Available	Available
EIC Fuel delivery pressure (Fuel outlet absolute pressure) (Fuel pump absolute pressure) (Fuel supply pressure)	Available	Available	Available
EIC Fuel temperature	-	Available	Available
EIC Coolant pressure	-	Available	-
EIC Blowby flow	-	Available	-
EIC Fuel rail pressure	-	Available	-
EIC Timing rail pressure	-	Available	-
EIC Aftercooler water inlet temp.	-	Available	-
EIC Fuel rank left	-	-	Available
EIC Fuel rank right	-	-	Available
EIC Intake pressure left	-	-	Available
EIC Intake pressure right	-	-	Available
EIC Intake temperature left	-	-	Available
EIC Intake temperature right	-	-	Available

4.6 Modbus communication

AGC, PPU, GPU and GPC only: If the Modbus option (H2) or Modbus TCP/IP option (N) is installed, the data can be transmitted to a PLC or a computer.

Refer to the chapter "Modbus communication" in this document for more information about our standard external Modbus communication from the Multi-line 2 controller unit to an external PLC (or computer).

5. Parameters

5.1 Further information

For further information, see the separate parameter list for the Multi-line unit in question:

AGC-3	Document number 4189340705
AGC-4	Document number 4189340688
GPC-3	Document number 4189340580
GPU-3/PPU-3	Document number 4189340581

6. Modbus communication

This chapter is to be considered as additional information for option H2/option N (Modbus TCP/IP). Refer to the ECM (Engine Communication Module) user manuals for more information about the ECM protocol technical description and the details of each communication value.

General data table, common to all Cummins types

Data table (bytes, read only registers, function code 03)

Object	Modbus address	No. of bytes	Scaling	Refresh time (s)
Engine speed	42000	2	8	0.5
Coolant temperature	42001	2	64	0.5
Oil pressure	42002	2	64	0.5
Battery voltage	42003	2	64	0.5
Frequency adjust pot.	42004	2	80	0.5
Droop adjust pot.	42005	2	256	2.0
Ambient air absolute pressure	42006	2	64	2.0
Engine running time	42007	4	10	2.0
ECM on time	42009	4	1	2.0
Base frequency	42011	2	80	2.0
Base speed	42012	2	8	2.0
Final speed reference	42013	2	8	2.0
Estimated torque	42014	2	1	2.0
±0.2 V speed bias	42015	2	80	2.0
±2.5 V speed bias	42016	2	80	2.0
Fuel consumption rate	42017	2	100	2.0
Cumulative fuel consumption	42018	4	100	2.0
Governor gain adjust pot.	42020	2	256	2.0
Active warning fault events list_fault code	42032	32	1	5.0
Active shutdown fault events list_fault code	42048	32	1	5.0

Data table (bits, read only, function code 02)

Object	Modbus address	No. of bits	Scaling	Refresh time (s)
Idle/rate switch state	22000	1	1	2.0
Run/stop switch state	22001	1	1	2.0
Remote emergency stop input	22002	1	1	2.0
Coolant level switch state	22003	1	1	2.0
Common shutdown lamp/relay driver command	22004	1	1	2.0
Common warning lamp/relay driver command	22005	1	1	2.0
Fuel shut-off valve driver state	22006	1	1	2.0
Operator interface mode	22007	4	1	2.0

A. Cummins QSX15 protocol

Data table (read only registers, function code 03)

Object	Modbus address	No. of bytes	Scaling	Refresh time (s)
Intake manifold absolute pressure	42512	2	64	2.0
Intake manifold temperature	42513	2	64	2.0
Fuel outlet absolute pressure	42514	2	64	2.0
Oil temperature	42515	2	64	2.0

B. Cummins QSK23, QSK45, QSK60 or QSK78 protocol

Data table (read only registers, function code 03)

Object	Modbus address	No. of bytes	Scaling	Refresh time (s)
Blowby flow	42528	2	128	2.0
Intake manifold absolute pressure	42529	2	64	2.0
Intake manifold temperature	42530	2	64	2.0
Coolant absolute pressure	42531	2	64	2.0
Fuel pump absolute pressure	42532	2	64	2.0
Fuel rail absolute pressure	42533	2	64	2.0
Fuel inlet temperature	42534	2	64	2.0
Timing rail absolute pressure	42535	2	64	2.0
Aftercooler water inlet temperature	42536	2	64	2.0

C. Cummins QST30 protocol

Data table (read only registers, function code 03)

Object	Modbus address	No. of bytes	Scaling	Refresh time (s)
Fuel rank left	42544	2	128	2.0
Fuel rank right	42545	2	128	2.0
Intake pressure left	42546	2	64	2.0
Intake pressure right	42547	2	64	2.0
Intake temperature left	42548	2	64	2.0
Intake temperature right	42549	2	64	2.0
Coolant pressure	42550	2	64	2.0
Oil temperature	42551	2	64	2.0
Fuel supply pressure	42552	2	64	2.0
Fuel temperature	42553	2	64	2.0