# Introduction

# The purpose of this standard is to provide a uniform protocol for communicating with any generating set control equipment. It allows all telemetry information relevant to a generating set to be read from the control equipment, regardless of manufacturer or specification, and allows basic operations such as starting and stopping the engine, transferring the load etc. to be performed remotely.

# This standard does not define how to program the control equipment, or transfer manufacturer specific information such as configurations to or from the equipment.

# This standard does not define the physical link, but is compatible with RS232, RS423, RS485, modem links or any similar system. This standard uses the Modbus protocol, complete details of which can be found on the Modbus web site http://www.modbus.org/

# General Definitions and Requirements

## Notes

1. A single piece of generating set control equipment is referred to as a ‘control unit’.
2. A control unit is always a slave device as defined in the Modbus protocol.
3. A PC, building management system or similar system is referred to as a ‘master device’ as defined in the Modbus protocol.
4. A hub is a device which connects a master device to one or more control units, to a master it appears as a slave and to a control unit it appears as a master.
5. A control unit connected to a hub is referred to as a satellite device of the hub.
6. The term ‘slave device’ refers either to a control unit or to a hub when it is viewed from a masters point of view.
7. The transmission mode used shall be RTU not ASCII.
8. The byte format over an RS485 link shall be 1 start bit, 8 data bits, no parity bit and 2 stop bits as defined by the Modbus protocol, the 73xx family is an exception to this rule as they always uses 1 stop bit.
9. The byte format over an RS232 link to a modem or direct to a PC shall be 1 start bit, 8 data bits, no parity bit and 1 stop bit which is the de-facto standard for modems.
10. The baud rate used will be one of those listed in Page 1 – Communications Configuration.
11. Bus time-outs must be detected by the master, as defined in the Modbus protocol.
12. For details of the Unicode character representation refer to the Unicode standard version 2.0 published by the Unicode Consortium.
13. Unicode strings may contain the control code 0x000A which shall be interpreted as “move to the beginning of the next line down”.
14. Any software that reads a Unicode string may either use the control code 0x000A to split the string into separate lines or may replace it with 0x0020 if it is desired to display the string on a single line, it must not be ignored as this may lead to the concatenation of words.
15. In this standard the term ‘ASCII character’ refers to an 8 bit character following the sub-set of Unicode from 0 to 255, it does not refer to any other published standard of character representation to avoid the ambiguities in such standards.
16. The form 0x12AB refers to a hexadecimal number, all other numbers are in decimal.
17. This document describes GenComm version 1, future upgrades of this standard will increase this version number by 1 and must be fully backwards compatible with all previous versions.
18. Any software written to interface with a GenComm version n slave device will be able to interface with a GenComm version n+1, n+2 etc. slave device without modification, and will be able to perform any operation defined in version n, but will not, of course, be able to perform functions added in later versions.
19. Any software written to interface with a GenComm version n slave devices will recognise a GenComm version n-1 slave device (from the ‘Communications Status Information’ page) and perform all operations defined in version n-1 on that slave device, it will not attempt to perform any operations added in later versions of GenComm on that slave device.

## 8.2 Function 16 – Write Multiple Registers

Writes one or more 16 bit registers to the slave device.

## Notes:

1. The limit of 123 registers is to comply with the Modbus specification which requires that a message must not exceed 256 bytes including all fields.
2. A write to a register that is defined in this standard but not implemented on this slave device will return extended exception 4 (Register not implemented) and have no other affect.
3. A write to a register that is defined in this standard as unimplemented will return extended exception 4 (Register not implemented) and have no other affect.
4. A write to a register that is defined in this standard as containing some unimplemented bits will only affect the implemented bits, the state of the unimplemented bits is irrelevant.
5. An attempt to write to a register that is defined as reserved in this standard will return extended exception code 12 (Reserved register) and have no other affect.
6. A write to a multi-register value such as a 32 bit value, a password or a string must be performed by a single message, not by multiple ones. This avoids the possibility of a value being partly current and partly old data.
7. The maximum allowable writing frequency to 19odbus registers should be limited to 10 times per second, to prolong the life of the module it is recommended that registers are only written to when their value needs to be changed ( avoid writing the same data repeatedly ).

## Query message

|  |  |  |
| --- | --- | --- |
| Byte | Field name | Notes |
| 0 | Slave address |  |
| 1 | Function code (16) |  |
| 2 | First register address – high byte | 16 bit register address |
| 3 | First register address – low byte |
| 4 | Number of registers to write – high byte | 16 bit number of registers, must be in the range 1 to 123 |
| 5 | Number of registers to write – low byte |
| 6 | Byte count (n) | 8 bit even number in the range 2 to 246 (number of registers \*2) |
| 7 | First register – high byte | 16 bit register |
| 8 | First register – low byte |
| … |  |  |
| 5+n | Last register – high byte | 16 bit register |
| 6+n | Last register – low byte |
| 7+n/8+n | Error check CRC |  |

**Normal response message**

|  |  |  |
| --- | --- | --- |
| Byte | Field name | Notes |
| 0 | Slave address |  |
| 1 | Function code (16) |  |
| 2 | First register address – high byte | 16 bit register address |
| 3 | First register address – low byte |
| 4 | Number of registers written – high byte | 16 bit number of registers, must be in the range 1 to 123 |
| 5 | Number of registers written – low byte |
| 6/7 | Error check CRC |  |

**Exception response message**

|  |  |  |
| --- | --- | --- |
| Byte | Field name | Notes |
| 0 | Slave address |  |
| 1 | Function code +128 (144) | Top bit is set |
| 2 | Exception code | 1 – Illegal function code 2 – Illegal data address 6 – Slave device busy |
| ¾ | Error check CRC |  |

# 10. Modbus Registers Defined

## Notes:

1. The register array is divided into 256 pages each containing up to 256 registers, the actual register address is obtained from the formula: register\_address=page\_number\*256+register\_offset.
2. All unused parts of pages 0-127 are defined as reserved for expansion of this standard, any attempt to access them will result in an exception response with extended exception code 12 (Reserved register).
3. Pages 128-255 are available for manufacturer specific applications such as configuration of the control equipment, these are not defined by this standard.
4. Any device which requires registers in pages 128-255 to be implemented in order to perform a task which can be performed by registers defined in this standard is deemed to be non-compliant with this standard.
5. This document always refers to register addresses which start at 0 as defined in the Modbus protocol. Register numbers, which start at 1, are not used in this document in order to avoid confusion.
6. The additional instrumentation pages are to be defined.
7. S.M. means state machine.
8. A letter S in the bits/sign column indicates a signed value using two’s compliment arithmetic, all others are unsigned.
9. A double number in the bits/sign column indicates a bit within a register of a specific size e.g. 16/16 is the most significant bit and 1/16 is the least significant bit of a 16 bit register.
10. Bits within registers are numbered from 1 not 0 to avoid the confusion that would be caused if the sixteenth bit of a 16 bit register were labelled 15/16.
11. For an integer type register the register contents should be multiplied by the scaling factor to obtain the actual value.
12. For a flag type register (1 bit) the minimum value column indicates the meaning if the flag is 0, the maximum column indicates the meaning if the flag is 1.
13. For an integer type register the minimum and maximum value columns indicate the minimum and maximum values after multiplying by the scaling factor.
14. Any software that reads an integer type register must be able to process and display correctly over the full range specified in the minimum and maximum value columns.
15. 32 bit values are stored with the most significant bits in the register with the lowest address.
16. Where two ASCII characters are stored in a single register the first character is in the most significant bits.
17. The first register of a 32 bit number is always aligned at an even address for the benefit of some 32 bit CPUs.

## 10.1 Index of Register Pages

|  |  |  |
| --- | --- | --- |
| Page number | Description | Read/write |
| 0 | Communications status information | Read only |
| 1 | Communications configuration | Read/write and write only |
| 2 | Modem configuration | Read/write |
| 3 | Generating set status information | Read only |
| 4 | Basic instrumentation | Read only |
| 5 | Extended instrumentation | Read only |
| 6 | Derived Instrumentation | Read only |
| 7 | Accumulated Instrumentation | Read/write |
| 8 | Alarm conditions | Read only |
| 9 | Total Harmonic Distortion information | Read only |
| 10 | Reserved |  |
| 11 | Diagnostic – general | Read only |
| 12 | Diagnostic – digital inputs | Read only |
| 13 | Diagnostic – digital outputs | Read only and read write |
| 14 | Diagnostic – LEDs | Read only and read write |
| 15 | Diagnostic – Reserved |  |
| 16 | Control registers | Read only and write only |
| 17 | J1939 active diagnostic trouble codes in decoded format | Read only |
| 18 | J1939 active diagnostic trouble codes in raw format | Read only |
| 19 | Reserved |  |
| 20 | Various strings | Read only |
| 24 | Identity strings | Read/write |
| 26 | State machine name strings | Read only |
| 28 | State machine state strings | Read only |
| 29-31 | Reserved |  |

* 1. **Page 4 – Basic Instrumentation Notes:**
1. These are read only registers.
2. The meaning of the mains, generator and bus phase rotation codes is given in the table below.
3. Registers 95-123 have been added to support the 8680 although not all will be implemented initially.
4. Registers 180 to 192 added to allow mimics of either S1 or S2 load/watts/lead-lag registers according to which side is on load.
5. If oil pressure is set to wide range signed value, this instrument is available in page 5. Register 0 in page 4 will reflect all positive values and will be set to the under measureable range sentinel for negative values.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Register add (Hex) | Register offset | Name | Minimum value | Maximum value | Scaling factor | Units | Bits/ sign |
| 0400 | 0 | Oil pressure | 0 | 10000 | 1 | Kpa | 16 |
| 0401 | 1 | Coolant temperature | -50 | 200 | 1 | Degrees C | 16 S |
| 0402 | 2 | Oil temperature | -50 | 200 | 1 | Degrees C | 16 S |
| 0403 | 3 | Fuel level | 0 | 130 | 1 | % | 16 |
| 0404 | 4 | Charge alternator voltage | 0 | 40 | 0.1 | V | 16 |
| 0405 | 5 | Engine Battery voltage | 0 | 40 | 0.1 | V | 16 |
| 0406 | 6 | Engine speed | 0 | 6000 | 1 | RPM | 16 |
| 0407 | 7 | Generator frequency | 0 | 70 | 0.1 | Hz | 16 |
| 0408 | 8-9 | Generator L1-N voltage | 0 | 18,000 | 0.1 | V | 32 |
| 040A | 10-11 | Generator L2-N voltage | 0 | 18,000 | 0.1 | V | 32 |
| 040C | 12-13 | Generator L3-N voltage | 0 | 18,000 | 0.1 | V | 32 |
| 040E | 14-15 | Generator L1-L2 voltage | 0 | 30,000 | 0.1 | V | 32 |
| 0410 | 16-17 | Generator L2-L3 voltage | 0 | 30,000 | 0.1 | V | 32 |
| 0412 | 18-19 | Generator L3-L1 voltage | 0 | 30,000 | 0.1 | V | 32 |
| 0414 | 20-21 | Generator L1 current | 0 | 99,999.9 | 0.1 | A | 32 |
| 0416 | 22-23 | Generator L2 current | 0 | 99,999.9 | 0.1 | A | 32 |
| 0418 | 24-25 | Generator L3 current | 0 | 99,999.9 | 0.1 | A | 32 |
| 041A | 26-27 | Generator earth current | 0 | 99,999.9 | 0.1 | A | 32 |
| 041C | 28-29 | Generator L1 watts | -99,999,999 | 99,999,999 | 1 | W | 32 S |
| 041E | 30-31 | Generator L2 watts | -99,999,999 | 99,999,999 | 1 | W | 32 S |
| 0420 | 32-33 | Generator L3 watts | -99,999,999 | 99,999,999 | 1 | W | 32 S |
| 0422 | 34 | Generator current lag/lead | -180 | +180 | 1 | degrees | 16 S |
| 0423 | 35 | Mains frequency | 0 | 70 | 0.1 | Hz | 16 |
| 0424 | 36-37 | Mains L1-N voltage | 0 | 18,000 | 0.1 | V | 32 |
| 0426 | 38-39 | Mains L2-N voltage | 0 | 18,000 | 0.1 | V | 32 |
| 0428 | 40-41 | Mains L3-N voltage | 0 | 18,000 | 0.1 | V | 32 |
| 042A | 42-43 | Mains L1-L2 voltage | 0 | 30,000 | 0.1 | V | 32 |
| 042C | 44-45 | Mains L2-L3 voltage | 0 | 30,000 | 0.1 | V | 32 |
| 042E | 46-47 | Mains L3-L1 voltage | 0 | 30,000 | 0.1 | V | 32 |
| 0430 | 48 | Mains voltage phase lag/lead | -180 | +180 | 1 | degrees | 16 S |
| 0431 | 49 | Generator phase rotation | 0 | 3 |  |  | 16 |
| 0432 | 50 | Mains phase rotation | 0 | 3 |  |  | 16 |
| 0433 | 51 | Mains current lag/lead | -180 | +180 | 1 | degrees | 16 S |
| 0434 | 52-53 | Mains L1 current | 0 | 99,999.9 | 0.1 | A | 32 |
| 0436 | 54-55 | Mains L2 current | 0 | 99,999.9 | 0.1 | A | 32 |
| 0438 | 56-57 | Mains L3 current | 0 | 99,999.9 | 0.1 | A | 32 |
| 043A | 58-59 | Mains earth current | 0 | 99,999.9 | 0.1 | A | 32 |
| 043C | 60-61 | Mains L1 watts | -99,999,999 | 99,999,999 | 1 | W | 32 S |
| 043E | 62-63 | Mains L2 watts | -99,999,999 | 99,999,999 | 1 | W | 32 S |
| 0440 | 64-65 | Mains L3 watts | -99,999,999 | 99,999,999 | 1 | W | 32 S |
| 0442 | 66 | Bus current lag/lead | -180 | +180 | 1 | degrees | 16 S |
| 0443 | 67 | Bus frequency | 0 | 70 | 0.1 | Hz | 16 |
| 0444 | 68-69 | Bus L1-N voltage | 0 | 18,000 | 0.1 | V | 32 |
| 0446 | 70-71 | Bus L2-N voltage | 0 | 18,000 | 0.1 | V | 32 |
| 0448 | 72-73 | Bus L3-N voltage | 0 | 18,000 | 0.1 | V | 32 |
| 044A | 74-75 | Bus L1-L2 voltage | 0 | 30,000 | 0.1 | V | 32 |
| 044C | 76-77 | Bus L2-L3 voltage | 0 | 30,000 | 0.1 | V | 32 |
| 044E | 78-79 | Bus L3-L1 voltage | 0 | 30,000 | 0.1 | V | 32 |

## Basic instrumentation continued

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Register add (Hex) | Register offset | Name | Minimum value | Maximum value | Scaling factor | Units | Bits/ sign |
| 0450 | 80-81 | Bus L1 current | 0 | 99,999.9 | 0.1 | A | 32 |
| 0452 | 82-83 | Bus L2 current | 0 | 99,999.9 | 0.1 | A | 32 |
| 0454 | 84-85 | Bus L3 current | 0 | 99,999.9 | 0.1 | A | 32 |
| 0456 | 86-87 | Bus earth current | 0 | 99,999.9 | 0.1 | A | 32 |
| 0458 | 88-89 | Bus L1 watts | -999,999,999 | 999,999,999 | 1 | W | 32 S |
| 045A | 90-91 | Bus L2 watts | -999,999,999 | 999,999,999 | 1 | W | 32 S |
| 045C | 92-93 | Bus L3 watts | -999,999,999 | 999,999,999 | 1 | W | 32 S |
| 045E | 94 | Bus phase rotation | 0 | 3 |  |  | 16 |
| 045F | 95 | Bus 2 frequency | 0 | 70 | 0.1 | Hz | 16 |
| 0460 | 96-97 | Bus 2 L1-N voltage | 0 | 18,000 | 0.1 | V | 32 |
| 0462 | 98-99 | Bus 2 L2-N voltage | 0 | 18,000 | 0.1 | V | 32 |
| 0464 | 100-101 | Bus 2 L3-N voltage | 0 | 18,000 | 0.1 | V | 32 |
| 0466 | 102-103 | Bus 2 L1-L2 voltage | 0 | 30,000 | 0.1 | V | 32 |
| 0468 | 104-105 | Bus 2 L2-L3 voltage | 0 | 30,000 | 0.1 | V | 32 |
| 046A | 106-107 | Bus 2 L3-L1 voltage | 0 | 30,000 | 0.1 | V | 32 |
| 046C | 108-109 | Bus 2 L1 current | 0 | 99,999.9 | 0.1 | A | 32 |
| 046E | 110-111 | Bus 2 L2 current | 0 | 99,999.9 | 0.1 | A | 32 |
| 0470 | 112-113 | Bus 2 L3 current | 0 | 99,999.9 | 0.1 | A | 32 |
| 0472 | 114-115 | Bus 2 earth current | 0 | 99,999.9 | 0.1 | A | 32 |
| 0474 | 116-117 | Bus 2 L1 watts | -999,999,999 | 999,999,999 | 1 | W | 32 S |
| 0476 | 118-119 | Bus 2 L2 watts | -999,999,999 | 999,999,999 | 1 | W | 32 S |
| 0478 | 120-121 | Bus 2 L3 watts | -999,999,999 | 999,999,999 | 1 | W | 32 S |
| 047A | 122 | Bus 2 phase rotation | 0 | 3 |  |  | 16 |
| 047B | 123 | Bus 2 current lag/lead | -180 | +180 | 1 | degrees | 16 S |
| 047C | 124 | S1 frequency | 0 | 70 | 0.1 | Hz | 16 |
| 047D | 125-126 | S1 L1-N voltage | 0 | 18,000 | 0.1 | V | 32 |
| 047F | 127-128 | S1 L2-N voltage | 0 | 18,000 | 0.1 | V | 32 |
| 0481 | 129-130 | S1 L3-N voltage | 0 | 18,000 | 0.1 | V | 32 |
| 0483 | 131-132 | S1 L1-L2 voltage | 0 | 30,000 | 0.1 | V | 32 |
| 0485 | 133-134 | S1 L2-L3 voltage | 0 | 30,000 | 0.1 | V | 32 |
| 0487 | 135-136 | S1 L3-L1 voltage | 0 | 30,000 | 0.1 | V | 32 |
| 0489 | 137-138 | S1 L1 current | 0 | 99,999.9 | 0.1 | A | 32 |
| 048B | 139-140 | S1 L2 current | 0 | 99,999.9 | 0.1 | A | 32 |
| 048D | 141-142 | S1 L3 current | 0 | 99,999.9 | 0.1 | A | 32 |
| 048F | 143-144 | S1 earth current | 0 | 99,999.9 | 0.1 | A | 32 |
| 0491 | 145-146 | S1 L1 watts | -99,999,999 | 99,999,999 | 1 | W | 32 S |
| 0493 | 147-148 | S1 L2 watts | -99,999,999 | 99,999,999 | 1 | W | 32 S |
| 0495 | 149-150 | S1 L3 watts | -99,999,999 | 99,999,999 | 1 | W | 32 S |
| 0497 | 151 | S1 current lag/lead | -180 | +180 | 1 | degrees | 16 S |
| 0498 | 152 | S2 frequency | 0 | 70 | 0.1 | Hz | 16 |
| 0499 | 153-154 | S2 L1-N voltage | 0 | 18,000 | 0.1 | V | 32 |
| 049B | 155-156 | S2 L2-N voltage | 0 | 18,000 | 0.1 | V | 32 |
| 049D | 157-158 | S2 L3-N voltage | 0 | 18,000 | 0.1 | V | 32 |
| 049F | 159-160 | S2 L1-L2 voltage | 0 | 30,000 | 0.1 | V | 32 |
| 04A1 | 161-162 | S2 L2-L3 voltage | 0 | 30,000 | 0.1 | V | 32 |
| 04A3 | 163-164 | S2 L3-L1 voltage | 0 | 30,000 | 0.1 | V | 32 |
| 04A5 | 165-166 | S2 L1 current | 0 | 99,999.9 | 0.1 | A | 32 |
| 04A7 | 167-168 | S2 L2 current | 0 | 99,999.9 | 0.1 | A | 32 |
| 04A9 | 169-170 | S2 L3 current | 0 | 99,999.9 | 0.1 | A | 32 |
| 04AB | 171-172 | S2 earth current | 0 | 99,999.9 | 0.1 | A | 32 |
| 04AD | 173-174 | S2 L1 watts | -99,999,999 | 99,999,999 | 1 | W | 32 S |
| 04AF | 175-176 | S2 L2 watts | -99,999,999 | 99,999,999 | 1 | W | 32 S |
| 04B1 | 177-178 | S2 L3 watts | -99,999,999 | 99,999,999 | 1 | W | 32 S |
| 04B3 | 179 | S2 current lag/lead | -180 | +180 | 1 | degrees | 16 S |
| 04B4 | 180-181 | Load L1 current | 0 | 99,999.9 | 0.1 | A | 32 |
| 04B6 | 182-183 | Load L2 current | 0 | 99,999.9 | 0.1 | A | 32 |
| 04B8 | 184-185 | Load L3 current | 0 | 99,999.9 | 0.1 | A | 32 |
| 04BA | 186-187 | Load L1 watts | -99,999,999 | 99,999,999 | 1 | W | 32 S |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 04BC | 188-189 | Load L2 watts | -99,999,999 | 99,999,999 | 1 | W | 32 S |
| 04BE | 190-191 | Load L3 watts | -99,999,999 | 99,999,999 | 1 | W | 32 S |
| 04C0 | 192 | Load current lag/lead | -180 | +180 | 1 | degrees | 16 S |
| 04C1 | 193 | S1 phase rotation | 0 | 3 |  |  | 16 |
| 04C2 | 194 | S2 phase rotation | 0 | 3 |  |  | 16 |
| 04C3 | 195 | Governor output | -100.0 | +100.0 | 0.1 | % | 16S |
| 04C4 | 196 | AVR output | -100.0 | +100.0 | 0.1 | % | 16S |
| 04C5 | 197 | DC Plant Battery Charge State | 0.0 | 100.0 | 0.1 | % | 16 |
| 04C6 | 198 | DC Plant Battery Discharge State | 0.0 | 100.0 | 0.1 | % | 16 |
| 04C7 | 199 | DC Voltage | 0.0 | 75.0 | 0.1 | V | 16 |
| 04C8 | 200-201 | DC Shunt 1 Current | - 1,250,000.0 | + 1,250,000.0 | 0.1 | A | 32S |
| 04CA | 202-203 | DC Shunt 2 Current | - 1,250,000.0 | + 1,250,000.0 | 0.1 | A | 32S |
| 04CC | 204-205 | DC Load Current | - 2,500,000.0 | + 2,500,000.0 | 0.1 | A | 32S |
| 04CE | 206-207 | DC Plant Battery Current | - 2,500,000.0 | + 2,500,000.0 | 0.1 | A | 32S |
| 04D0 | 208-209 | DC Total Current | - 2,500,000.0 | + 2,500,000.0 | 0.1 | A | 32S |
| 04D2 | 210-211 | DC Plant Battery Cycles | 0 | 99999 |  |  | 32 |
| 04D4 | 212-213 | DC Charger Watts | -99,999,999 | 99,999,999 | 1 | W | 32 S |
| 04D6 | 214-215 | DC Plant Battery Watts | -99,999,999 | 99,999,999 | 1 | W | 32 S |
| 04D8 | 216-217 | DC Load Watts | -99,999,999 | 99,999,999 | 1 | W | 32 S |
| 04DA | 218-219 | DC Total Watts | -99,999,999 | 99,999,999 | 1 | W | 32 S |
| 04DC | 220 | DC Charge Mode | 0 | 2 |  |  | 16 |
| 04DD | 221 | DC Plant Battery temperature | -50 | 200 | 1 | Degrees C | 16 S |
| 04DE | 222 | DC Battery Cycle State | 0 | 2 |  |  | 16 |
| 04DF | 223 | Mains zero sequence voltage angle | -360.0 | +360.0 | 0.1 | Degrees | 16S |
| 04E0 | 224 | Mains positive sequence voltage angle | -360.0 | +360.0 | 0.1 | Degrees | 16S |
| 04E1 | 225 | Mains negative sequence voltage angle | -360.0 | +360.0 | 0.1 | Degrees | 16S |
| 04E2 | 226-227 | Mains zero sequence voltage magnitude | 0 | 30,000 | 0.1 | V | 32 |
| 04E4 | 228-229 | Mains positive sequence voltage magnitude | 0 | 30,000 | 0.1 | V | 32 |
| 04E6 | 230-231 | Mains negative sequence voltage magnitude | 0 | 30,000 | 0.1 | V | 32 |
| 04E8 | 232-233 | Battery Charger Output Current | 0 | 50,000 | 1 | mA | 32S |
| 04EA | 234-235 | Battery Charger Output Voltage | 0 | 100,000 | 1 | mV | 32S |
| 04EC | 236-237 | Battery Open Circuit Voltage | 0 | 100,000 | 1 | mV | 32S |
| 04EE | 238-239 | Load L1-N voltage (8661) | 0 | 18,000 | 0.1 | V | 32 |
| 04F0 | 240-241 | Load L2-N voltage (8661) | 0 | 18,000 | 0.1 | V | 32 |
| 04F2 | 242-243 | Load L3-N voltage (8661) | 0 | 18,000 | 0.1 | V | 32 |
| 04F4 | 244-245 | Load L1-L2 voltage (8661) | 0 | 30,000 | 0.1 | V | 32 |
| 04F6 | 246-247 | Load L2-L3 voltage (8661) | 0 | 30,000 | 0.1 | V | 32 |
| 04F8 | 248-249 | Load L3-L1 voltage (8661) | 0 | 30,000 | 0.1 | V | 32 |
| 04FA | 250 | Load frequency | 0 | 70 | 0.1 | Hz | 16 |
| 04FB | 251 | Load phase rotation | 0 | 3 |  |  | 16 |
| 04FC | 252-253 | Battery Charger Auxiliary Voltage | 0 | 100,000 | 1 | mV | 32S |
| 04FE | 254-255 | Battery Charger Auxiliary Current | 0 | 50,000 | 1 | mV | 32S |

**Phase rotation codes**

|  |  |
| --- | --- |
| Code | Meaning |
| 0 | Indeterminate – the voltage on one or more phase is insufficient to measure the rotation |
| 1 | L1 leads L2 which leads L3 |
| 2 | L3 leads L2 which leads L1 |
| 3 | Phase error – two or more phase inputs are in phase |
| 4-65534 | Reserved |
| 65535 | Unimplemented |

## DC Charge Mode

|  |  |
| --- | --- |
| Code | Meaning |
| 0 | Discharging |
| 1 | Charging |
| 2 | Floating |
| 4-65534 | Reserved |
| 65535 | Unimplemented |

**DC Battery Cycle State**

|  |  |
| --- | --- |
| Code | Meaning |
| 0 | Unknown |
| 1 | Full Discharged Reached |
| 2 | Full Charge Reached |
| 3-65534 | Reserved |
| 65535 | Unimplemented |

## Page 5 – Extended Instrumentation Notes:

1. These are read only registers.
2. Each auxiliary sender has a register describing its type as shown in the table below.
3. Auxiliary sender values are always signed regardless of the category.
4. An unused auxiliary sender should return the appropriate unimplemented sentinel in both the category and value registers, however, some products may return a 0 value in the category register to indicate that it is unimplemented.
5. Registers 12-15 have been added to 55xx from version 9 upwards.
6. Registers 16-17 have been added to 8xxx from version 2 upwards.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Register add (Hex) | Register offset | Name | Minimum value | Maximum value | Scaling factor | Units | Bits/ Sign |
| 0500 | 0 | Coolant pressure 1 | 0 | 10000 | 1 | Kpa | 16 |
| 0501 | 1 | Coolant pressure 2 | 0 | 10000 | 1 | Kpa | 16 |
| 0502 | 2 | Fuel pressure 1 | 0 | 10000 | 1 | Kpa | 16 |
| 0503 | 3 | Fuel pressure 2 | 0 | 10000 | 1 | Kpa | 16 |
| 0504 | 4 | Turbo pressure 1 | 0 | 10000 | 1 | Kpa | 16 |
| 0505 | 5 | Turbo pressure 2 | 0 | 10000 | 1 | Kpa | 16 |
| 0506 | 6 | Inlet manifold temperature 1 | -50 | 10000 | 1 | Degrees C | 16 S |
| 0507 | 7 | Inlet manifold temperature 2 | -50 | 10000 | 1 | Degrees C | 16 S |
| 0508 | 8 | Exhaust temperature 1 | -50 | 10000 | 1 | Degrees C | 16 S |
| 0509 | 9 | Exhaust temperature 2 | -50 | 10000 | 1 | Degrees C | 16 S |
| 050A | 10-11 | Fuel consumption | 0 | 10000 | 0.01 | L/hour | 32 |
| 050C | 12 | Water in Fuel |  |  |  |  | 16 |
| 050D | 13 | CAN BIT data |  |  |  |  | 16 |
| 050E | 14 | Atmospheric pressure | 0 | 10000 | 1 | Kpa | 16 |
| 050F | 15 | Fuel temperature | -50 | 10000 | 1 | Degrees C | 16 S |
| 0510 | 16-17 | Fuel level (Units) <8xxx phase 2>\*Litre/Imp Gal/US Gal | 0 | 999,999,999 | 1 | \* | 32 |
| 0512 | 18 | Selected units for fuel level <8xxx phase 2> | 0 | 2 |  |  | 16 |
|  | 19-47 | Reserved |  |  |  |  |  |
| 0530 | 48 | Auxiliary sender 1 category | 0 | 3 |  |  | 16 |
| 0531 | 49 | Auxiliary sender 1 value | See table below | 16 S |
| 0532 | 50 | Auxiliary sender 2 category | 0 | 3 |  |  | 16 |
| 0533 | 51 | Auxiliary sender 2 value | See table below | 16 S |
| 0534 | 52 | Auxiliary sender 3 category | 0 | 3 |  |  | 16 |
| 0535 | 53 | Auxiliary sender 3 value | See table below | 16 S |
| 0536 | 54 | Auxiliary sender 4 category | 0 | 3 |  |  | 16 |
| 0537 | 55 | Auxiliary sender 4 value | See table below | 16 S |
|  | 56-63 | Reserved |  |  |  |  |  |
| 0540 | 64-65 | Exhaust after treatment fuel used | 0 | 2105 | 1 | Litres | 32 U |
| 0542 | 66 | After treatment temperature T1 | 0 | 1734 | 1 | Degrees C | 16 S |
| 0543 | 67 | After treatment temperature T3 | 0 | 1734 | 1 | Degrees C | 16 S |
| 0544 | 68-69 | Engine reference torque | 0 | 6425 | 1 | Nm | 32U |
| 0546 | 70-71 | Engine percentage torque | -125 | 125 | 1 | % | 32S |
| 0548 | 72-73 | Engine demand torque | -125 | 125 | 1 | % | 32S |
| 054A | 74 | Percentage load at speed | 0 | 250 | 1 | % | 16 U |
| 054B | 75 | Accelerator position | 0 | 100 | 1 | % | 16 U |
| 054C | 76 | Nominal friction percentage torque | -125 | 125 | 1 | % | 16 S |
| 054D | 77 | Oil level | 0 | 100 | 1 | % | 16 U |
| 055E | 78 | Crank case pressure | -25000 | 25000 | 0.01 | kPa | 16 S |
| 055F | 79 | Coolant level | 0 | 100 | 1 | % | 16 U |
| 0550 | 80 | Injector Rail 1 pressure | 0 | 2509 | 0.01 | Mpa | 16 U |
| 0551 | 81 | Injector Rail 2 pressure | 0 | 2509 | 0.01 | Mpa | 16 U |
| 0552 | 82 | Engine EGR flow | 0 | 3212 | 1 | kg/h | 16 U |
| 0553 | 83 | Pre filter oil pressure | 0 | 1000 | 1 | kPa | 16 U |
| 0554 | 84-85 | Instant break power | 0 | 3212 | 1 | kW | 32 U |
| 0556 | 86 -101 | Exhaust gas port 1-16 temperature | -273 | 1734 | 1 | Degrees C | 16 S |
| 0566 | 102 | Intercooler temperature | -40 | 210 | 1 | Degrees C | 16 S |
| 0567 | 103 | Turbo oil temperature | -273 | 1734 | 1 | Degrees C | 16 S |
| 0568 | 104 | ECU temperature | -273 | 1734 | 1 | Degrees C | 16 S |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Register add (Hex) | Register offset | Name | Minimum value | Maximum value | Scaling factor | Units | Bits/ Sign |
| 0569 | 105 | Fan speed | 0 | 8031 | 1 | rpm | 16 U |
| 056A | 106-107 | Total engine revolutions | 0 | 4211 | 0.001 |  | 32 U |
| 056C | 108 | Air inlet pressure | 0 | 500 | 1 | kPa | 16 U |
| 056D | 109 | Air filter differential pressure | 0 | 125 | 0.1 | kPa | 16 U |
| 056E | 110 | Air trap inlet pressure | 0 | 125 | 1 | kPa | 16 U |
| 056F | 111 | Turbo pressure 3 | 0 | 8031 | 1 | kPa | 16 U |
| 0570 | 112 | Turbo pressure 4 | 0 | 8031 | 1 | kPa | 16 U |
| 0571 | 113 | Inlet manifold temperature 3 | -40 | 210 | 1 | Degrees C | 16 S |
| 0572 | 114 | Inlet manifold temperature 4 | -40 | 210 | 1 | Degrees C | 16 S |
| 0573 | 115 | Inlet manifold temperature 5 | -40 | 210 | 1 | Degrees C | 16 S |
| 0574 | 116 | Inlet manifold temperature 6 | -40 | 210 | 1 | Degrees C | 16 S |
| 0575 | 117-118 | Trip fuel | 0 | 2105 | 1 | Litres | 32 U |
| 0577 | 119 | Electrical potential |  |  | 0.1 | V | 16 U |
| 0578 | 120 | PGI Engine type |  |  |  |  | 16 U |
| 0579 | 121 | PGI Engine version number |  |  |  |  | 16 U |
| 057A | 122 | DPTC filter lamp command | 0 | 7 | See table |  | 16 U |
| 057B | 123 | Exhaust system high temperature lamp | 0 | 7 |  |  | 16 U |
| 057C | 124 | DPTC Action regeneration forced | 0 | 7 | See table |  | 16 U |
| 057D | 125 | Shutdown wait to start |  |  |  |  | 16 U |
| 057E | 126 | Shutdown protection |  |  |  |  | 16 U |
| 057F | 127 | Shutdown Approaching |  |  |  |  | 16 U |
| 0580 | 128 | Engine operating state | 0 | 15 | See table |  | 16 U |
| 0581 | 129 | Shutdown coolant override |  |  |  |  | 16 U |
| 0582 | 130 | Battle short override |  |  |  |  | 16 U |
| 0583 | 131 | Module engine hours |  |  |  |  | 16 U |
| 0584 | 132 | Module oil pressure |  |  |  |  | 16 U |
| 0585 | 133 | Module coolant temperature |  |  |  |  | 16 U |
| 0586 | 134 | Module engine RPM |  |  |  |  | 16 U |
| 0587 | 135 | Module charge alternator |  |  |  |  | 16 U |
| 0588 | 136 | Module speed feed |  |  |  |  | 16 U |
| 0589 | 137 | Frequency adjust |  |  |  |  | 16 U |
| 058A | 138 | Engine operating state |  |  |  |  | 16 U |
| 058B | 139 | Engine alarm warning |  |  |  |  | 16 U |
| 058C | 140 | Engine alarm shutdown |  |  |  |  | 16 U |
| 058D | 141 | Engine alarm electrical trip |  |  |  |  | 16 U |
| 058E | 142 | CAN amber stop lamp |  |  |  |  | 16 U |
| 058F | 143 | CAN amber lamp flash |  |  |  |  | 16 U |
| 0590 | 144 | CAN Red stop lamp |  |  |  |  | 16 U |
| 0591 | 145 | CAN red lamp flash |  |  |  |  | 16 U |
| 0592 | 146 | CAN protect lamp |  |  |  |  | 16 U |
| 0593 | 147 | CAN protect lamp flash |  |  |  |  | 16 U |
| 0594 | 148 | Malfunction Lamp |  |  |  |  | 16 U |
| 0595 | 149 | Malfunction lamp flash |  |  |  |  | 16 U |
| 0596 | 150 | Electrical potential |  |  |  |  | 16 U |
| 0597 | 151 | Battery potential |  |  | 0.1 | V | 16 U |
| 0598 | 152 | Charging potential |  |  | 0.1 | V | 16 U |
| 0599 | 153 | Charge alternator current |  |  | 1 | A | 16 U |
| 059A | 154 | Battery current |  |  | 1 | A | 16 S |
| 059B | 155 | Engine torque mode |  |  |  |  | 16 U |
| 059C | 156 | Engine starter mode |  |  |  |  | 16 U |
| 059D | 157 | CAN CI status |  |  |  |  | 16 U |
| 059E | 158 | Demand speed |  |  |  |  | 16 U |
| 059F | 159 | Speed up |  |  |  |  | 16 U |
| 05A0 | 160 | Speed down |  |  |  |  | 16 U |
| 05A1 | 161 | Speed fail |  |  |  |  | 16 U |
| 05A2 | 162 | Current SD source |  |  |  |  | 16 U |
| 05A3 | 163 | Feedback SD CAN |  |  |  |  | 16 U |
| 05A4 | 164 | Feedback SD analogue |  |  |  |  | 16 U |
| 05A5 | 165 | Failure codes |  |  |  |  | 16 U |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Register add (Hex) | Register offset | Name | Minimum value | Maximum value | Scaling factor | Units | Bits/ Sign |
| 05A6 | 166 | Actual droop |  |  |  |  | 16 U |
| 05A7 | 167 | Start status |  |  |  |  | 16 U |
| 05A8 | 168 | Protection override status |  |  |  |  | 16 U |
| 05A9 | 169 | MTU running state |  |  |  |  | 16 U |
| 05AA | 170 | Cylinder cut off |  |  |  |  | 16 U |
| 05AB | 171 | Load gen status |  |  |  |  | 16 U |
| 05AC | 172 | Extended stop status |  |  |  |  | 16 U |
| 05AD | 173 | Current operating mode |  |  |  |  | 16 U |
| 05AE | 174 | MTU required torque |  |  |  |  | 16 U |
| 05AF | 175 | Trip average fuel |  |  | 0.01 | L/hour | 16 U |
| 05B0 | 176 | ECU rated power |  |  | 1 | kW | 16 U |
| 05B1 | 177 | ECU rated speed |  |  | 1 | RPM | 16 U |
| 05B2 | 178 | ECU idle speed |  |  | 1 | RPM | 16 U |
| 05B3 | 179 | ECU desired speed |  |  | 1 | RPM | 16 U |
| 05B4 | 180 | ECU preheat status |  |  |  |  | 16 U |
| 05B5 | 181 | Manifold pressure |  |  | 1 | kPa | 16 U |
| 05B6 | 182 | Intercooler level |  |  | 1 | % | 16 U |
| 05B7 | 183 | CAN link status |  |  |  |  | 16U |
| 05B8 | 184 | Auto DPF Regeneration Inhibit |  |  |  |  | 16U |
| 05B9 | 185 | DPTC Active Regeneration Inhibit Switch (received from engine) SPN 3703 |  |  |  |  | 16U |
| 05BA | 186 | Soot Load | 0 |  | 1 | % | 16U |
| 05BB | 187 | Ash Load | 0 |  | 1 | % | 16U |
| 05BC | 188-189 | Reserved |  |  |  |  |  |
| 05BE | 190 | LCD Temperature | -100 | 200 | 1 | Degrees C | 16S |
| 05BF | 191 | DEF Tank Level |  |  |  | % | 16U |
| 05C0 | 192 | DEF Tank Temperature |  |  |  | Degrees C | 16S |
| 05C1 | 193 | DEF Level Status |  |  |  |  | 16U |
| 05C2 | 194 | DEF Consumption |  |  |  | L/hour | 16U |
| 05C3 | 195 | Aftertreatment Status Reason |  |  |  |  | 16U |
| 05C4 | 196 | Aftertreatment Status Severity |  |  |  |  | 16U |
| 05C5 | 197 | Time left until action needed |  |  |  | s | 16U |
| 05C6 | 198 | Time until Torque Reduction |  |  |  | s | 16U |
| 05C7 | 199 | Time until Speed Reduction |  |  |  | s | 16U |
| 05C8 | 200 | EGR Pressure |  |  |  | kPa | 16U |
| 05C9 | 201 | EGR Temperature |  |  |  | Degrees C | 16S |
| 05CA | 202 | Ambient Air Temperature |  |  |  | Degrees C | 16S |
| 05CB | 203 | Air Intake Temperature |  |  |  | Degrees C | 16S |
| 05CC | 204 | DEF Lamps – SCR Inducement | 0 | 15 |  | \* | 16U |
| 05CD | 205 | DEF Lamps – DEF Level Low | 0 | 15 |  | \* | 16U |
| 05CE | 206 | Generator high-resolution frequency | 0 | 70 | 0.01 | Hz | 16 |
| 05CF | 207 | Mains high-resolution frequency | 0 | 70 | 0.01 | Hz | 16 |
| 05D0 | 208 | Bus high-resolution frequency | 0 | 70 | 0.01 | Hz | 16 |
| 05D1 | 209 | Bus 2 high-resolution frequency | 0 | 70 | 0.01 | Hz | 16 |
| 05D2 | 210 | Oil Pressure | -100 | 10000 | 1 | kPa | 16 S |
| 05D3 | 211 | CAN Alternate engine speed selected | 0 | 1 | 0 |  | 16 |
| 05D4 | 212-213 | Generator Excitation Field Current |  |  |  | A | 32U |
| 05D6 | 214-215 | Generator Excitation Field Voltage |  |  |  | V | 32U |
| 05D8 | 216 | Generator Output Voltage Bias Percentage |  |  |  | % | 16U |
| 05DB | 217-220 | Exhaust gas port 17-20 temperature | -273 | 1734 | 1 | Degrees C | 16 S |
| 05DD | 221 | Instant Fuel Rate |  |  |  |  | 16U |
| 05DE | 222 | DPTC Filter Status |  |  |  |  | 16U |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Register add (Hex) | Register offset | Name | Minimum value | Maximum value | Scaling factor | Units | Bits/ Sign |
| 05DF | 223 | DPTC Active Regeneration Inhibit |  |  |  |  | 16U |
| 05E0 | 224 | DPTC Active Regeneration Inhibit ET |  |  |  |  | 16U |
| 05E1 | 225 | DEF Tank Status |  |  |  |  | 16U |
| 05E2 | 226 | Gas Fuel Pressure |  |  |  |  | 16U |
| 05E3 | 227 | Throttle Position 1 |  |  |  |  | 16U |
| 05E4 | 228 | Throttle Position 2 |  |  |  |  | 16U |
| 05E5 | 229-230 | DC Charger Current | - 2,500,000.0 | + 2,500,000.0 | 0.1 | A | 32S |
| 05E7 | 231 | Trip Average Fuel Efficiency | 0 | 10.00 | 0.01 | kW Hour/L | 16U |
| 05E8 | 232 | Instantaneous Fuel Efficiency | 0 | 10.00 | 0.01 | kW Hour/L | 16U |
|  | 233-255 | Reserved |  |  |  |  |  |

\*See table below

## 94xx Battery charger register allocation

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Register add (Hex) | Register offset | Name | Minimum value | Maximum value | Scaling factor | Units | Bits/ Sign |
|  | 0-185 | Reserved |  |  |  |  |  |
|  | 186-187 | Battery Charger Current Limit | 0 | 50,000 | 1 | mA | 32S |
|  | 188 | Battery Charger Calculated Ambient Temperature | -255 | 255 | 1 | Degrees C | 16S |
|  | 189 | Battery Charger PCB Temperature | -300 | 255 | 1 | Degrees C | 16S |
|  | 190-191 | Auxiliary Current Limit | 0 | 4000 | 1 | mA | 32S |
|  | 192 | Fan Speed 1 | 10 | 2400 | 1 | rpm | 16S |
|  | 193 | Fan Speed 2 | 10 | 2400 | 1 | rpm | 16S |
|  | 194 | Battery Voltage(when remote Sense connected) |  |  | 0.1 | V | 16S |
|  | 195-255 | Reserved |  |  |  |  |  |

**Auxiliary & Flexible sender category codes**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Type code | Type | Minimum value | Maximum value | Scaling factor | Units |
| 0 | Unused | 0 | 0 |  |  |
| 1 | Pressure | 0 | 10000 | 1 | Kpa |
| 2 | Temperature | -50 | 10000 | 1 | Degrees C |
| 3 | Level | 0 | 200 | 1 | % |
| 4-65535 | Reserved |  |  |  |  |

## Fuel Level codes

|  |  |
| --- | --- |
| Type code | Type |
| 0 | Litres |
| 1 | Imperial Gallons |
| 2 | US Gallons |
| 3-65535 | Reserved |

**Engine operating state**

|  |  |
| --- | --- |
| Type code | Type |
| 0 | Engine stopped |
| 1 | Pre-Start |
| 2 | Warming up |
| 3 | Running |
| 4 | Cooling down |
| 5 | Engine Stopped |
| 6 | Post run |
| 7 |  |
| 8-13 | Available for SAE assignment |
| 14 | Reserved |
| 15 | Not available |

## DPTC filter lamp command

|  |  |
| --- | --- |
| Type code | Type |
| 0 | Off |
| 1 | On – solid |
| 2-3 | Reserved for SAE assignment |
| 4 | On Fast blink (1Hz) |
| 5-6 | Reserved for SAE assignment |
| 7 | Not available |

**Exhaust system high temperature lamp**

|  |  |
| --- | --- |
| Type code | Type |
| 0 | Engine stopped |
| 1 | Pre-Start |
| 2-6 | Available for SAE assignment |
| 7 | Not available |

## DPTC Action regeneration forced

|  |  |
| --- | --- |
| Type code | Type |
| 0 | Not active |
| 1 | Active forced by switch |
| 2 | Active forced by service tool |
| 3-6 | Not Available |
| 7 | Not available |

**CAN link status codes**

|  |  |
| --- | --- |
| Type code | Type |
| 0 | Link OK |
| 1 | Link Lost |
| 2 | Link Unknown |
| 65535 | Unimplemented |
| 3-65534 | Reserved |

## Auto DPF Regeneration Inhibit

|  |  |
| --- | --- |
| Type code | Type |
| 0 | Auto regeneration permitted |
| 1 | Auto regeneration inhibited |
| 3-65534 | Reserved |

**DEF Lamps**

|  |  |
| --- | --- |
| Type code | Type |
| 0 | Off |
| 1 | On Steady (amber/yellow steady) |
| 2 | Flash Slow (red slow blink) |
| 3 | Flash Fast (red fast blink) |
| 11 | Bad Data |
| 15 | Unimplemented |

## 10.9 Page 7 – Accumulated Instrumentation Notes:

1. These are read/write registers though some systems may not support writing to some registers.

## 8xxx/7xxx/6xxx/L40x/4xxx register allocation

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Register add (Hex) | Register offset | Name | Minimum value | Maximum value | Scaling factor | Units | Bits/ Sign |
| 0700 | 0-1 | Current time since 1/1/70 | 0 | 4.29 x109 | 1 | Seconds | 32 |
| 0702 | 2-3 | Time to next engine maintenance | -2.14 x109 | 2.14 x109 | 1 | Seconds | 32S |
| 0704 | 4-5 | Time of next engine maintenance since 1/1/70 | 0 | 4.29 x109 | 1 | Seconds | 32 |
| 0706 | 6-7 | Engine run time | 0 | 4.29 x109 | 1 | Seconds | 32 |
| 0708 | 8-9 | Generator positive KW hours | 0 | 4.29 x109 | 0.1 | KW hour | 32 |
| 070A | 10-11 | Generator negative KW hours | 0 | 4.29 x109 | 0.1 | KW hour | 32 |
| 070C | 12-13 | Generator KVA hours | 0 | 4.29 x109 | 0.1 | KVA hour | 32 |
| 070E | 14-15 | Generator KVAr hours | 0 | 4.29 x109 | 0.1 | KVAr hour | 32 |
| 0710 | 16-17 | Number of starts | 0 | 99999 |  |  | 32 |
| 0712 | 18-19 | Mains positive KW hours | 0 | 4.29 x109 | 0.1 | KW hour | 32 |
| 0714 | 20-21 | Mains negative KW hours | 0 | 4.29 x109 | 0.1 | KW hour | 32 |
| 0716 | 22-23 | Mains KVA hours | 0 | 4.29 x109 | 0.1 | KVA hour | 32 |
| 0718 | 24-25 | Mains KVAr hours | 0 | 4.29 x109 | 0.1 | KVAr hour | 32 |
| 071A | 26-27 | Bus positive KW hours | 0 | 4.29 x109 | 0.1 | KW hour | 32 |
| 071C | 28-29 | Bus negative KW hours | 0 | 4.29 x109 | 0.1 | KW hour | 32 |
| 071E | 30-31 | Bus KVA hours | 0 | 4.29 x109 | 0.1 | KVA hour | 32 |
| 0720 | 32-33 | Bus KVAr hours | 0 | 4.29 x109 | 0.1 | KVAr hour | 32 |
| 0722 | 34-35 | Fuel used | 0 | 4.29 x109 | 1 | Litre | 32 |
| 0724 | 36-37 | Maximum positive mains R.O.C.O.F. | 0 | 10.00 | 0.01 | Hz/s | 32 |
| 0726 | 38-39 | Maximum negative mains R.O.C.O.F. | 0 | 10.00 | 0.01 | Hz/s | 32 |
| 0728 | 40-41 | Maximum positive mains vector shift | 0 | 360.0 | 0.1 | Degrees | 32 |
| 072A | 42-43 | Maximum negative mains vector shift | 0 | 360.0 | 0.1 | Degrees | 32 |
| 072C | 44-45 | Time to next engine maintenance alarm 1 | -2.14 x109 | 2.14 x109 | 1 | Seconds | 32S |
| 072E | 46-47 | Time of next engine maintenance alarm 1 since 1/1/70 | 0 | 4.29 x109 | 1 | Seconds | 32 |
| 0730 | 48-49 | Time to next engine maintenance alarm 2 | -2.14 x109 | 2.14 x109 | 1 | Seconds | 32S |
| 0732 | 50-51 | Time of next engine maintenance alarm 2 since 1/1/70 | 0 | 4.29 x109 | 1 | Seconds | 32 |
| 0734 | 52-53 | Time to next engine maintenance alarm 3 | -2.14 x109 | 2.14 x109 | 1 | Seconds | 32S |
| 0736 | 54-55 | Time of next engine maintenance alarm 3 since 1/1/70 | 0 | 4.29 x109 | 1 | Seconds | 32 |
| 0738 | 56-57 | Time to next plant battery maintenance | -2.14 x109 | 2.14 x109 | 1 | Seconds | 32S |
| 073A | 58-59 | Time of next plant battery maintenance since 1/1/70 | 0 | 4.29 x109 | 1 | Seconds | 32 |
| 073C | 60-61 | Cycles to next plant battery maintenance | 0 | 4.29 x109 | 1 | Numeric | 32 |
| 073E | 62-63 | Capacity remaining to next plant battery maintenance | 0 | 4.29 x109 | 1 | Percentage | 32 |
| 0740 | 64-65 | Time to next plant battery maintenance alarm 1 | -2.14 x109 | 2.14 x109 | 1 | Seconds | 32S |
| 0742 | 66-67 | Time of next plant battery maintenance alarm 1 since 1/1/70 | 0 | 4.29 x109 | 1 | Seconds | 32 |
| 0744 | 68-69 | Cycles to next plant battery maintenance alarm 1 | 0 | 4.29 x109 | 1 | Numeric | 32 |
| 0746 | 70-71 | Capacity remaining to next plant battery maintenance alarm 1 | 0 | 4.29 x109 | 1 | Percentage | 32 |
| 0748 | 72-73 | Time to next plant battery maintenance alarm 2 | -2.14 x109 | 2.14 x109 | 1 | Seconds | 32S |
| 074A | 74-75 | Time of next plant battery maintenance alarm 2 since 1/1/70 | 0 | 4.29 x109 | 1 | Seconds | 32 |
| 074C | 76-77 | Cycles to next plant battery maintenance alarm 2 | 0 | 4.29 x109 | 1 | Numeric | 32 |
| 074E | 78-79 | Capacity remaining to next plant battery maintenance alarm 2 | 0 | 4.29 x109 | 1 | Percentage | 32 |
| 0750 | 80-81 | Time to next plant battery maintenance | -2.14 x109 | 2.14 x109 | 1 | Seconds | 32S |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | alarm 3 |  |  |  |  |  |
| 0752 | 82-83 | Time of next plant battery maintenance alarm 3 since 1/1/70 | 0 | 4.29 x109 | 1 | Seconds | 32 |
| 0754 | 84-85 | Cycles to next plant battery maintenance alarm 3 | 0 | 4.29 x109 | 1 | Numeric | 32 |
| 0756 | 86-87 | Capacity remaining to next plant battery maintenance alarm 3 | 0 | 4.29 x109 | 1 | Percentage | 32 |
| 0758 | 88-89 | Plant Battery Run Time | 0 | 4.29 x109 | 1 | Seconds | 32 |
| 075A | 90-91 | Plant Battery Cycles | 0 | 99999 |  |  | 32 |
| 075C | 92-93 | Plant Battery Charge State | 0 | 100.0 | 0.1 | % | 16 |
| 075E | 94-95 | Load kWh | 0 | 4.29 x109 | 0.1 | kW hour | 32 |
| 0760 | 96-97 | Battery charging kWh | 0 | 4.29 x109 | 0.1 | kW hour | 32 |
| 0762 | 98-99 | Battery discharging kWh | 0 | 4.29 x109 | 0.1 | kW hour | 32 |
| 0764 | 100 | Fuel Efficiency KWh/L (accumulated) | 0 | 65535 | 0.01 | kW hour/L | 16 |
|  | 101-255 | Reserved |  |  |  |  |  |