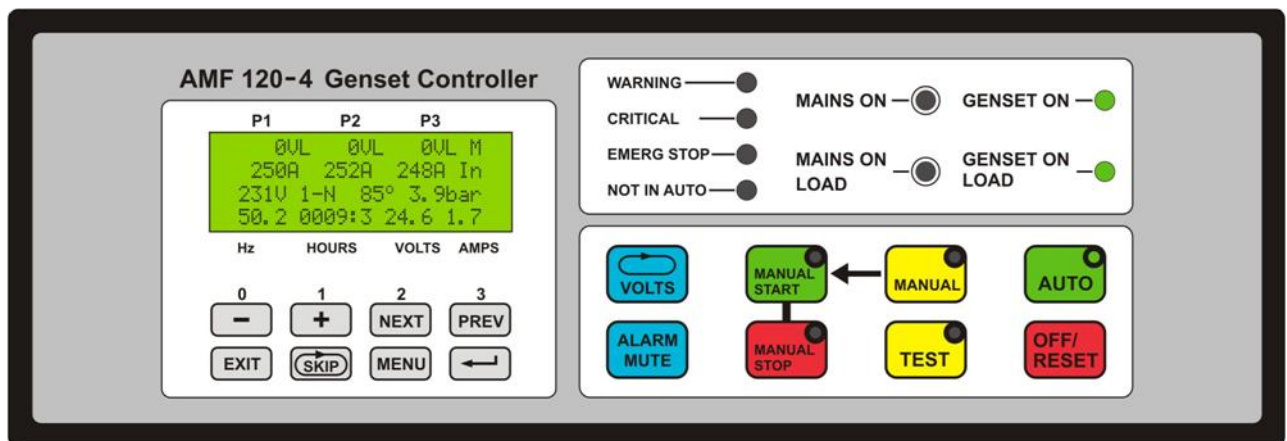
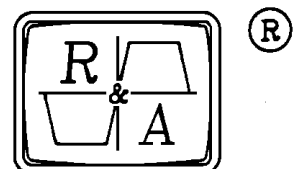


TECHNICAL SPECIFICATION FOR AMF120-4 RS-485 Modbus Option



Reid & Associates CC



PH: +27 31 205 3329 Fax: +27 31 205 4060

www.reid.co.za

e-mail: info@reid.co.za

Document No: AMF120-4 Modbus	Classification (C) 2009 REID & ASSOCIATES CC	Rev: 11 Date: 30 November 2009
--	--	---

AMENDMENT HISTORY				
Rev	Description of Changes	S/W Ver No.	H/W Ver No.	Date
01	First Release	1.0	1.0	30 January 2009
02	Changed range for Water Temp. page 14	1.0	1.0	01 February 2009
03	Corrected range of Canbus SPN & FMI	1.0	1.0	02 February 2009
04	Corrected Register02 Mains Register description	1.0	1.0	11 February 2009
05	Added Register 41 Modbus Option Digital Inputs	1.0	1.0	13 February 2009
06	Corrected '3.3.3 Hardware Connection Table 3', changed Warning Alarm & Start Inhibit Alarm – delete Mains Circuit Breaker OFF. Corrected '23 Fuel Level %... Range 0-99%'.	1.0	1.0	14 April 2009
07	Corrected '3.2.1.2 02-Mains Register Table', order of bits incorrect in document.	1.1	1.0	9 July 2009
08	Expanded description of Register 41, Modbus Option Digital Inputs register	1.1	1.0	28 July 2009
09	Corrected '3.2.1.8 08-Start Inhibit Alarms Table', order of bits & description incorrect in document.	1.2	1.0	17 September 2009
10	As per meeting with Alcatel, Process Control and Integration Technology and P&S Power. Register 41 – Modbus Option Digital Inputs change allocation of Inputs 3 & 4	1.2	1.0	16 November 2009
11	As the functions assigned to Register 41 – Modbus Option Digital Inputs are customer specific, remove allocation of functions to Digital Inputs & 01 – Summary Register bit 8. Hardware Connection Pin 3 renamed to 'Common'.	1.2	1.0	30 November 2009

Document No: AMF120-4 Modbus	Classification (C) 2009 REID & ASSOCIATES CC	Rev: 11 Date: 30 November 2009
--	--	---

1. SCOPE

This document describes how the AMF120-4 is connected to a remote Computer via a three-wire (twisted pair plus screen), half-duplex RS485 connection and the format of the Genset data.

2. DEFINITION

A sub-set of the Modbus RTU protocol, based on the "MODBUS over Serial Line Specification and Implementation Guide V1.02" and "Modbus Application Protocol Specification V1.1b", is implemented.

3. RS485 INTERFACE

3.1 Physical Layer

3.1.1 RS485 Data Format

The Communication Parameters are listed in Table 1 below.

Parameter	Value
Data Rate	9600 Baud
Word Length	8 Bits
Parity	Even
Stop Bits	1
Handshaking	None

Table 1. Communication Parameters.

3.1.2 RS485 Transceiver

The transceiver specifications are listed in Table 12 below.

Parameter	Value
Bus Loading	1/8 Maximum of 256 devices
Protection	Thermal shutdown and short-circuit
Safety	Outputs high-z when disabled or powered off
Isolation	2500V rms for 1 minute
Termination	None – connected externally as required

Table 2. Transceiver Specifications.

3.1.3 Hardware Connection

Connections between the AMF120-4 and the bus are listed in Table 3 below.

AMF120-4	
Pin No.	Description
1	B +
2	A -
3	COMMON

Table 3. Interconnect Requirements.

Document No: AMF120-4 Modbus	Classification (C) 2009 REID & ASSOCIATES CC	Rev: 11 Date: 30 November 2009
--	--	---

3.1.4 AMF120-4 Slave Address

The AMF120-4 Slave Address is set from 1 to 200 using the built in display and keypad.

3.2 Implemented Modbus Functions

3.2.1 03 (0x03) Read Holding Registers

The AMF120-4 Holding Registers are listed in Table 4 below.

Register	Description
01	Summary
02	Mains Status
03	Engine hours
04	Warning Alarm
05	Warning Canbus SPN
06	Warning Canbus FMI
07	Reserved
08	Start Inhibit Alarm
09	Reserved
10	Shutdown Alarm
11	Shutdown Alarm Canbus SPN
12	Shutdown Alarm Canbus FMI
13	Reserved
14	Mains P1-N volts
15	Mains P2-N volts
16	Mains P3-N volts
17	Mains P1-P2 volts
18	Mains P2-P3 volts
19	Mains P1-P3 volts
20	Reserved
21	Battery volts
22	Battery amps
23	Fuel level
24	Reserved
25	Alternator P1-N volts
26	Alternator P2-N volts
27	Alternator P3-N volts
28	Alternator P1-P2 volts
29	Alternator P2-P3 volts
30	Alternator P1-P3 volts
31	Alternator Frequency
32	Amps Format Flag

Register	Description
33	Alt. P1 amps
34	Alt. P2 amps
35	Alt. P3 amps
36	Alt. P1 amps Maximum
37	Alt. P2 amps Maximum
38	Alt. P3 amps Maximum
39	kW
40	Reserved
41	Modbus digital inputs
42	Water Temperature
43	Oil Pressure
44	State
45	S/W versions
46	Reserved
47	Reserved
48	Reserved
49	Reserved
50	Reserved
51	Reserved
52	Reserved
53	Reserved
54	Reserved
55	Reserved
56	Reserved
57	Reserved
58	Reserved
59	Reserved
60	Reserved
61	Reserved
62	Reserved
63	Reserved
64	Reserved

Document No: AMF120-4 Modbus	Classification (C) 2009 REID & ASSOCIATES CC	Rev: 11 Date: 30 November 2009
--	--	---

3.2.1.1 01 – Summary Register

The Summary register summarizes the Genset status in a single register. To reduce the polling time, read the Summary Register to determine a Genset status and only read the other registers if necessary.

If a bit is 1 the function is ACTIVE.

The Summary register is detailed in Table 5 below.

Description	Bit number
Genset controller Mode is OFF	0
Genset controller Mode is AUTO	1
Genset controller Mode is MANUAL	2
Genset controller Mode is MANUAL START	3
Genset controller Mode is MANUAL STOP	4
Genset controller Mode is TEST	5
Mains is OK	6
Mains is ON load	7
Modbus digital Inputs 1	8
Genset is OK	9
Genset is ON load	10
Start Inhibit Alarm	11
Start Fail	12
Emergency Stop is active	13
Warning Alarm	14
Shutdown Alarm	15

Table 5. Summary Register.

Document No: AMF120-4 Modbus	Classification (C) 2009 REID & ASSOCIATES CC	Rev: 11 Date: 30 November 2009
--	--	---

3.2.1.2 02 – Mains Register

The Mains register details any of the Mains phases which are below or above the low and high mains trip voltages.

If a bit is 1 the function is ACTIVE.

The Mains register is detailed in Table 6 below.

Description	Bit number
Mains phase rotation fault	0
Reserved	1
Mains phase 1 low voltage	2
Mains phase 1 high voltage	3
Mains phase 2 low voltage	4
Mains phase 2 high voltage	5
Mains phase 3 low voltage	6
Mains phase 3 high voltage	7
Reserved	8
Reserved	9
Reserved	10
Reserved	11
Reserved	12
Reserved	13
Reserved	14
Reserved	15

Table 6. Mains Register.

3.2.1.3 03 – Engine Hours

This register contains the Genset engine hours in tenths of an hour.

Range: 0-9999:9.

Example: 637 should be displayed as 63:7Hours

Document No: AMF120-4 Modbus	Classification (C) 2009 REID & ASSOCIATES CC	Rev: 11 Date: 30 November 2009
--	--	---

3.2.1.4 04 – Warning Alarm

The Warning Alarm register details Genset parameters which are below or above the normal operating range.

A Warning Alarm indicates a problem which needs attention but is not severe enough to shutdown the Genset.

If a bit is 1 the function is ACTIVE.

The Warning Alarm register is detailed in Table 6 below.

Description	Bit number
Low battery volts during cranking	0
Low battery volts	1
High battery volts	2
Charging alternator fault	3
Low fuel	4
Low bulk fuel	5
Oil pressure is low	6
Engine temperature is high	7
Reserved	8
Reserved	9
Reserved	10
Canbus Amber lamp	11
Reserved	12
Reserved	13
Reserved	14
Reserved	15

Table 6. Warning Alarms.

Document No: AMF120-4 Modbus	Classification (C) 2009 REID & ASSOCIATES CC	Rev: 11 Date: 30 November 2009
--	--	---

3.2.1.5 05 – Warning Canbus SPN

If there is a Canbus Amber lamp warning this register contains a number describing the fault.

Additional information about the fault is provided in the Warning Canbus FMI described in paragraph 3.2.1.6 on the next page.

Range: 0-65536.

The Warning Canbus SPN's are detailed in Table 7 below.

Number	Description
45	Pre-heat relay
94	Fuel pressure/ Fuel pressure sensor
97	Water in fuel/ Water in fuel sensor
98	Oil level/ Oil level sensor
100	Oil pressure/ Oil pressure sensor
102	Boost pressure/ Boost pressure sensor
105	Charge air temperature/ Charge air temperature sensor
106	Boost pressure/ Boost pressure sensor
110	Coolant temperature/ Coolant temperature sensor
111	Coolant level/ Coolant level sensor
153	Crankcase ventilation pressure/ Crankcase ventilation pressure sensor
175	Oil temperature/ Oil temperature sensor
190	Engine RPM

Table 7. Warning/ Shutdown Canbus SPN.

Document No: AMF120-4 Modbus	Classification (C) 2009 REID & ASSOCIATES CC	Rev: 11 Date: 30 November 2009
--	--	---

3.2.1.6 06 – Warning Canbus FMI

If there is a Canbus Amber lamp warning this register contains a number providing additional information about the fault in the Warning Canbus SPN.

Range: 0-31

The Warning Canbus FMI's are detailed in Table 8 below.

Number	Description	Severity
0	Data valid but ABOVE normal operational range	most
1	Data valid but BELOW normal operational range	most
2	Data erratic, intermittent or incorrect	
3	Voltage above normal or shorted to high source	
4	Voltage below normal or shorted to low source	
5	Current below normal or open circuit	
6	Current above normal or grounded circuit	
7	Mechanical system not responding or out of adjustment	
8	Abnormal frequency or pulse width or period	
9	Abnormal update rate	
10	Abnormal rate of change	
11	Root cause not known	
12	Bad intelligent device or component	
13	Out of calibration	
14	Special instructions	
15	Data valid but ABOVE normal operational range	least
16	Data valid but ABOVE normal operational range	moderate
17	Data valid but BELOW normal operational range	least
18	Data valid but BELOW normal operational range	moderate
19	Received network data	
20	Data drifted high	
21	Data drifted low	

Table 8. Warning/ Shutdown Canbus FMI.

3.2.1.7 07 – Reserved

Document No: AMF120-4 Modbus	Classification (C) 2009 REID & ASSOCIATES CC	Rev: 11 Date: 30 November 2009
--	--	---

3.2.1.8 08 – Start Inhibit Alarm

A Start Inhibit alarm is an alarm which would result in a Shutdown alarm once the Genset started.

The Start Inhibit alarms are detailed in Table 9 below.

Description	Bit number
Emergency Stop is engaged	0
Oil pressure sensor fault	1
Engine temperature sensor fault	2
Charging alternator fault	3
No Fuel	4
Low water level	5
Alternator volts	6
Remote Stop	7
No Canbus option	8
No Canbus signal	9
Reserved	10
Reserved	11
Reserved	12
Reserved	13
Reserved	14
Reserved	15

Table 9. Start Inhibit Alarms.

3.2.1.9 09 – Reserved

Document No: AMF120-4 Modbus	Classification (C) 2009 REID & ASSOCIATES CC	Rev: 11 Date: 30 November 2009
--	--	---

3.2.1.10 10 – Shutdown Alarm

The Shutdown Alarm register details the Genset alarm which caused a shutdown.
The Shutdown alarms are detailed in Table 10 below.

Description	Bit number
Emergency Stop is engaged	0
Start Fail	1
Low oil pressure	2
High engine temperature	3
No fuel	4
Low water level	5
Reserved	6
Remote Stop	7
Under-speed	8
Over-speed	9
Low Alternator volts	10
High Alternator volts	11
Phase rotation fault	12
Reserved	13
Reserved	14
Canbus shutdown	15

Table 10. Shutdown Alarms Alarms.

3.2.1.11 11 – Shutdown Alarm Canbus SPN

Use Table 7. Warning/ Shutdown Canbus SPN.

3.2.1.12 12 – Shutdown Alarm Canbus FMI

Use Table 8. Warning/ Shutdown Canbus FMI.

3.2.1.13 13 – Reserved

Document No: AMF120-4 Modbus	Classification (C) 2009 REID & ASSOCIATES CC	Rev: 11 Date: 30 November 2009
--	--	---

3.2.1.14 14 – Mains phase 1 to Neutral Volts

No scaling required & range: 0-300.

3.2.1.15 15 – Mains phase 2 to Neutral Volts

No scaling required & range: 0-300.

3.2.1.16 16 – Mains phase 3 to Neutral Volts

No scaling required & range: 0-300.

3.2.1.17 17 – Mains phase 1 to phase 2 Volts

No scaling required & range: 0-520.

3.2.1.18 18 – Mains phase 3 to phase 3 Volts

No scaling required & range: 0-520..

3.2.1.19 19 – Mains phase 1 to phase 3 Volts

No scaling required & range: 0-520.

3.2.1.20 20 – Reserved

3.2.1.21 21 – Battery Volts

This register contains the battery volts in tenths of a volt.

Range: 0-99,9.

Example: 248 should be displayed as 24,8V.

3.2.1.22 22 – Battery Amps

This register contains the battery charging amps in tenths of an amp.

Range: 0-9,9.

Example: 16 should be displayed as 1,6A.

3.2.1.23 23 – Fuel Level %

No scaling required & range 0-99.

3.2.1.24 24 – Reserved

Document No: AMF120-4 Modbus	Classification (C) 2009 REID & ASSOCIATES CC	Rev: 11 Date: 30 November 2009
--	--	---

3.2.1.25 25 – Alternator phase 1 to Neutral Volts

No scaling required & range: 0-300.

3.2.1.26 26 – Alternator phase 2 to Neutral Volts

No scaling required & range: 0-300.

3.2.1.27 27 – Alternator phase 3 to Neutral Volts

No scaling required & range: 0-300.

3.2.1.28 28 – Alternator phase 1 to phase 2 Volts

No scaling required & range: 0-520.

3.2.1.29 29 – Alternator phase 3 to phase 3 Volts

No scaling required & range: 0-520.

3.2.1.30 30 – Alternator phase 1 to phase 3 Volts

No scaling required & range: 0-520.

3.2.1.31 31 – Alternator Frequency

This register contains the alternator frequency in tenths of a Hz.

Range: 0-99,9.

Example: 502 should be displayed as 50,2Hz.

3.2.1.32 32 – Amps Format Flag

Always 0001Hex.

3.2.1.33 33 – Alternator phase 1 Amps

No scaling required & range: 0-9999.

3.2.1.34 34 – Alternator phase 2 Amps

No scaling required & range: 0-9999.

3.2.1.35 35 – Alternator phase 3 Amps

No scaling required & range: 0-9999.

Document No: AMF120-4 Modbus	Classification (C) 2009 REID & ASSOCIATES CC	Rev: 11 Date: 30 November 2009
--	--	---

3.2.1.36 36 – Alternator phase 1 Amps Maximum

No scaling required & range: 0-9999.

3.2.1.37 37 – Alternator phase 2 Amps Maximum

No scaling required & range: 0-9999.

3.2.1.38 38 – Alternator phase 3 Amps Maximum

No scaling required & range: 0-9999.

3.2.1.39 39 – Alternator kW

No scaling required & range: 0-9999.

3.2.1.40 40 – Reserved

3.2.1.41 41 – Modbus Option Digital Inputs

The Modbus Option Digital Inputs register contains the status of the four digital inputs on the Modbus option module.

These inputs are connected to battery negative through a relay or switch contact. An input is active if this switch contact is closed (fail safe).

If a bit is 1 the function is ACTIVE, contacts closed.

Bits 4 to 15 are always 0.

The Modbus Option Digital Inputs register is detailed in Table 11 below.

Description	Bit number
Input 1	0
Input 2	1
Input 3	2
Input 4	3

Table 11. Modbus Option Digital Inputs Register.

3.2.1.42 42 – Engine Temperature

Temperature is in Degrees Centigrade.

No scaling required & range: 20-120.

3.2.1.43 43 – Oil Pressure

This register contains the Oil Pressure in tenths of a Bar.

Example 1: 58 should be displayed as 5,8Bar & range: 0-9,9Bar.

OR

Example 2: 58 should be displayed as 580kPa & range: 0-999kPa.

Document No: AMF120-4 Modbus	Classification (C) 2009 REID & ASSOCIATES CC	Rev: 11 Date: 30 November 2009
--	--	---

3.2.1.44 44 – State

For engineering use – no units & range: 0-255.

3.2.1.45 45 – Software Version Numbers

Low byte is Modbus option version number.

Example: 13 should be displayed as V1,3.

High byte is AMF120-4 version number.

Example: 129 should be displayed as V1,29.

3.2.1.46 46 – Reserved

Document No: AMF120-4 Modbus	Classification (C) 2009 REID & ASSOCIATES CC	Rev: 11 Date: 30 November 2009
--	--	---