

AquaMaster 3

Electromagnetic flowmeter



The smart solution for
remote applications

Measurement made easy

—
AquaMaster 3
electromagnetic
flow sensors

Introduction

AquaMaster 3TM is a range of high performance electromagnetic flowmeters for the measurement of electrically-conductive fluids and is normally supplied as factory-configured, calibrated systems.

When the meter is taken out of storage and installed for first use, remove the protective label (if fitted) from the front to enable light to activate the unit.

If the meter is not powered, connect any batteries or external supply as detailed in the User Guide (OI/FET2XX-EN).

For more information

Further publications are available for free download from www.abb.com/flow or by scanning this code:



Search for or click on

User Guide
AquaMaster 3
Electromagnetic flowmeter

[OI/FET2XX-EN](http://www.abb.com/flow)

Related documents

AquaMaster 3	Search for or click on
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AquaMaster 3 FET200	
Electromagnetic flowmeter transmitter	

IMPORTANT NOTE

For devices manufactured before February 2022, kindly refer to earlier revision of the user guide (Revision C) –
[COI/FET2XX-EN Revision C](#)

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1 Controls and Display

When the meter is taken out of storage and installed for first use, remove the protective label (if fitted) from the front to enable light to activate the unit.

If the meter is not powered, connect any batteries or external supply as detailed in the User Guide (OI/FET2XX-EN).

The display is activated by light change. To turn the transmitter on, cover the front panel display area and remove the cover.

Note.  Refer to the User Guide (OI/FET2XX-EN) for battery condition monitoring.

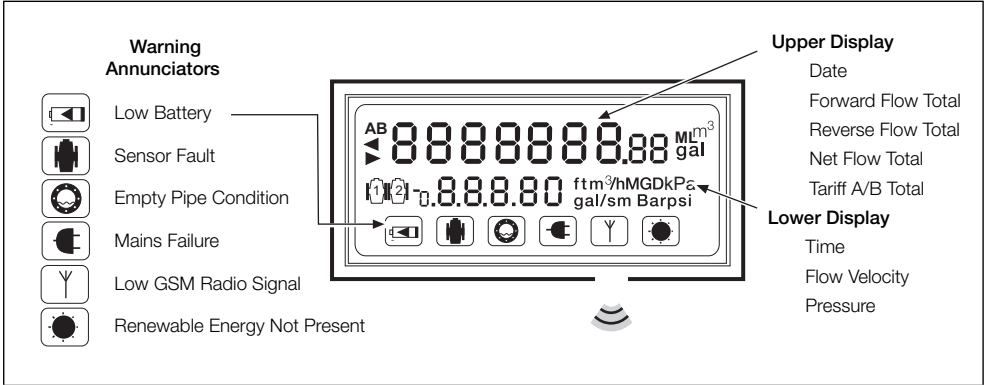


Fig. 1.1 AquaMaster 3 Display Information

2 Programming AquaMaster 3

This section describes:

- How to configure a communications terminal application to access the AquaMaster 3 menus via the AquaMaster 3 RS232 serial connection.
- How to navigate and use the AquaMaster 3 menus.

2.1 PC Communications Terminal Connection

To enable communications between AquaMaster 3 and a PC:

1. Connect the AquaMaster 3 to a computer via the AquaMaster 3 serial port connection – see User Guide (OI/FET2XX–EN) Section 3.3, 'Local Computer Connection'.
2. The USB signal lead requires a driver that can be downloaded from www.ftdichip.com/FTDrivers.htm.
3. Launch a system-compatible communications terminal application (for example, Windows HyperTerminal with Windows* NT / XP).

*Compatibility with other versions of Windows may vary.

2.1.1 Port Settings

Configure the communications terminal application using the following port settings:

- Baud (Bits per second): 4800
- Data bits: 8
- Parity: None
- Stop bits: 1
- Flow control: None

2.1.2 Microsoft HyperTerminal Setup

Note. This example uses Windows HyperTerminal running on a Windows NT or XP operating system.

To setup Microsoft HyperTerminal:

1. From the Windows *Start* menu select *Programs – Accessories – Communications – HyperTerminal*.
2. At *New connection* enter: *AquaMaster*.
3. At *Connect using* choose the relevant COM port (depending on the PC connection).
4. At *Port setting* prompt choose Bits per second: 4800, Data bits: 8; Parity: None; Stop bits: 1; Flow control: none.

2.2 AquaMaster 3 Menus

2.2.1 Accessing Programming Mode

To access the AquaMaster 3 programming mode:

- 1. Press **Tab** 3 times to activate the programming mode.

The following screen is displayed:

AquaMaster 3

Nav Mode: TAB, Disp Mode: Ctrl+W

2.2.2 Accessing Display Mode

To access display mode:

- 1. Press the **Ctrl** + **W** keys simultaneously to initiate display mode. This mode sends the same information defined for the AquaMaster 3 LCD Display (see Menu 3.0 Display Options, page 10).
- 2. Press **Esc** to cancel display mode.

2.2.3 Navigating Menus

To access the AquaMaster 3 menus after login:

- 1. Press the **Tab** key.

The following screen is displayed:

[Next Menu=TAB] [Next Item=ENTER]

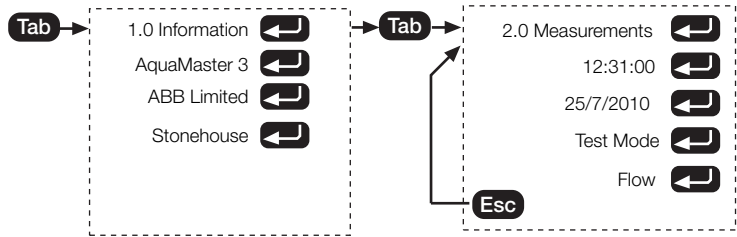
[Edit = SPACE] [Exit = ESC]

1.0 Information

- 2. To move between menus (1 to 13 depending on user privileges) press the **Tab** key.

To navigate through sub-menus press the **↵** key.

To exit sub-menus and return to the current menu press the **Esc** key.



Note. Pressing **M** within a menu displays all the remaining parameters immediately.

- 3. To exit all menus refer to Section 2.2.5, page 7.

2.2.4 Security Access

Password Control





The number of visible menus depends on the current access level as shown in table 2.1.

Level	Default Password	Menus
0	—	1 to 4
2	setup	1 to 7
4	am2k	1 to 14

Table 2.1 AquaMaster 3 Passwords

Note. Passwords are case-sensitive and can be changed in menu 4.0 – see page 11.

To login as a secure user*:

1. Access menu 4 (see see Section 2.2.3, page 5).
2. Press , . The message *0 Level Logged In* is displayed.
3. Press the  key.
A blank text box is displayed.
4. To login at level 2 type *setup* or to login at level 4 type *am2k*. Press .

The message *2 Level Logged In* or *4 Level Logged In* is displayed and access to secure levels is permitted.

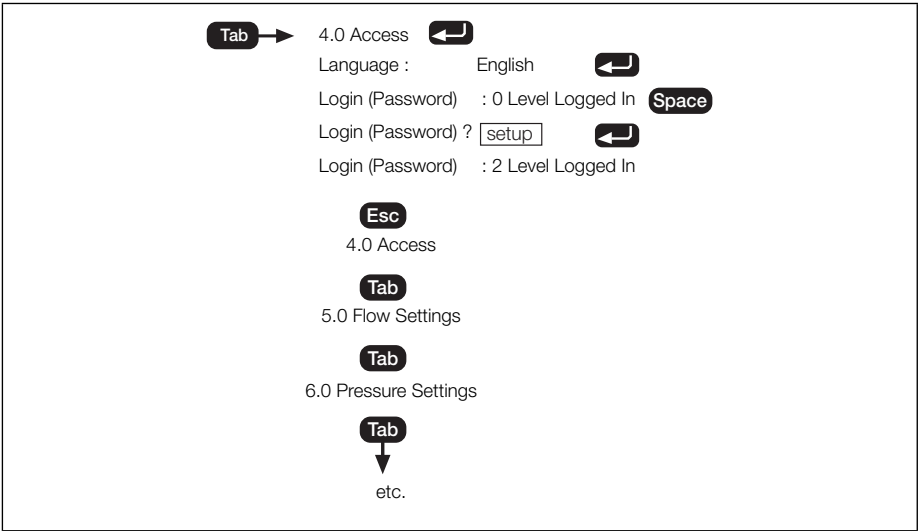



Fig. 2.1 Logging In

*To login at level 0, press  at step 3.

2.2.5 Exiting the Menu System

Note. The menus are exited automatically if no keys are pressed for 5 minutes.

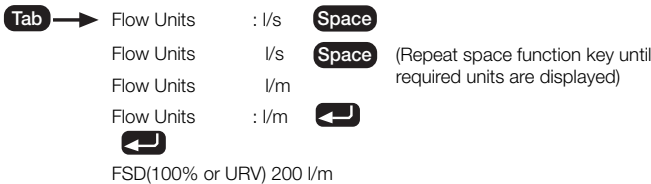
To exit the menus manually:

- 1. Press **Esc** repeatedly until the following message is displayed:
Disconnect MHS Y/N
- 2. Type *Y* to end the communication session.

When the menus are exited the *Access Level* is reset to level 0.

2.2.6 Parameter Changes

Changing Selections



Note. Press **Esc** to escape or cancel in input mode, or to exit a menu.

Command Line Interface

Note. Ensure that the correct access level is selected.

Data can be entered directly into the AquaMaster 3 without navigating the menu system. This is achieved using the 'Command Line Interface' (CLI).

To read the value of a variable:

- 1. Type a right chevron (**>**) followed by the variable number (see step 3, page 9), then press **↵**.

To write a new value to a variable:

- 2. Type a right chevron (**>**), the variable number (see step 3, page 9) and the new value required, followed by **↵**.

In both cases the AquaMaster 3 replies with the new value of the variable (or a reason for failure) – for example:

>217 **↵** <0>217=42
>217=42 **↵** <3>217=Write Access Denied

Where:

- 217 is the number for the flow rate
- <0> is the error code for 'no error'
- 42 is the current flow rate
- <3> is the error code for 'Write Access Denied', since writing to the flow rate is not permitted.

Example: to change the flow FSD to 10 m3/min

>248=setup		<0>248=2 Level Logged In	Comments
			Enter password
>112		<0>112=1 l/s	Read present flow units
>115		<0>115=250	Read present fsd
>115=10		<0>115=10	Set new fsd value of 10
>112=6		<0>112=6 m³/m	Set units to number 6 (m³/min)

3. To cancel password security, either exit the Menu System (see 2.2.5, page 7) or type:
 >248=0
to set the access level to Level 0.

2.2.7 Go To Menu

To navigate the AquaMaster 3 menus quickly, assuming that the menus have been activated (by pressing **Tab** 3 or 4 times) and that a suitable login level has been obtained:

1. Type the menu number then press .

For example, to navigate to menu 12 type:

12 **Tab**.

Menu 12 (*12.0 GSM Comms Settings*) is now accessed.

3 Menu Overview

3.1 All Versions

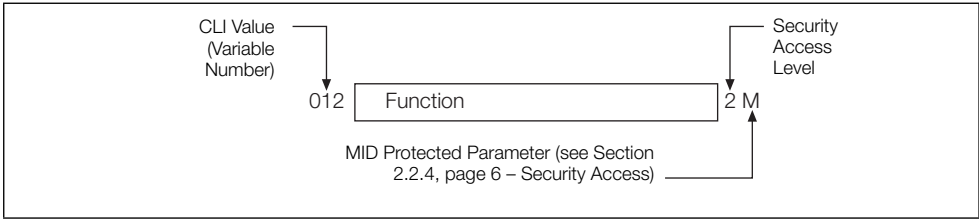


Fig. 3.1 Menu Item Format

1.0 Information			
199	AquaMaster 3	R	
200	ABB Limited	R	
201	Stonehouse	R	
202	England, UK, GL10 3TA	R	
203	tel +44 (0)1453 826661	R	
204	flow@gb.abb.com	R	
163	Owner :	2	
162	Location :	2	
206	Message :	2	
	Flow Sensor	R	
1	I.D. :	R	
17	Contract :	R	
8	Meter Type :	R	
27	Cal. Date :	4M	
28	Cert. No. :	4M	
33	Flow Tag/Site ID :	4	
237	Bore (mm) :	R	
21	Lining :	R	
22	Electrodes :	R	
23	Flanges :	R	
24	Body :	R	
106	Calibration Type	R	
	Pressure Sensor		
171	I.D. :	4	
196	Cal. Date :	4	
197	Cert. No. :	4	
189	Contract :	4	
191	Wetted Parts :	4	
192	Seals :	4	
	Transmitter	R	
207	I.D. :	R	
208	P.I.N. :	R	
209	Contract :	4M	
210	Cal. Date :	R	
212	Transmitter Tag :	2	
416	M.I.D. Switch :	R	
	Exit :	0	

2.0 Measurements		
253	Time :	4
254	Date :	4
233	Test Mode :	4M*
246	Start-up Check :	4
290	Alarm Code :	4@
217	Flow :	R
218	Flow % :	R
219	Velocity :	R#
222	Pressure :	4
223	Pressure % :	4
258	Pulse Output :	R
224	Fwd :	4 ^Z M
225	Rev :	4 ^Z M
226	Net :	4 ^Z M
227	Tariff A :	4 ^Z M
228	Tariff B :	4 ^Z M
234	Sig A (kOhm) :	R
235	Sig B (kOhm) :	R
	Exit :	0

* Test Mode sets the flow velocity to 1 m/s for test purposes. Only affects Fwd, Rev, Net totalizers and Pulse Output.

Z Reset to Zero only.

Velocity units may be altered to ft/s as follows (Write Level Access 2):

>109=5 <0>109=5 ft/s

>109=1 for m/s

@ See Section 6, page 26
(Alarm Information)

3.0 Display Options		
52	Fwd :	0
53	Rev :	0
54	Net :	0
55	Tariff A :	0
56	Tariff B :	0
59	Flow :	0
60	Velocity :	0
61	Pressure :	0
62	Date/Time :	0
159	Date Format :	2
	Exit :	0

Date Formats

DDMMYY

YYMMDD

MMDDYY

Note: Enter a new date in the same format as it is displayed, for example 2010/10/27.

If the year is entered as two digits, it is assumed to be in the range 1990 to 2089 inclusive.

4.0 Access			
161	Language	:	4
248	Login (Password)	:	0
249	Change Password	:	4
250	Current Password	:	4
251	New Password	:	4
252	Confirm New Password	:	R
	Exit	:	0

6.0 Pressure Settings (see Notes)			
66	Mode	:	2
119	Pressure Units	:	2
122	FSD (100% or URV)	:	2
123	Zero (0% or LRV)	:	2
120	Special Units (per Bar)	:	2
121	Special Pressure Name	:	2
	Exit	:	0

Units

Special*	mm Hg*
Bar	mm H ₂ O*
mBar	psi
kPa	ft H ₂ O*

*These units are not displayed

5.0 Flow Settings			
112	Flow Units	:	2
37	Totalizer Units	:	4M
67	Pulse Units		2
68	Pulses/Unit	:	2
69	Pulse Max Freq.	:	2
113	Special Units (per m ³ /s)	:	2
114	Special Flow Name	:	2
38	Special Units (per m ³)	:	4M
39	Special Totalizer Name	:	4M
115	FSD (100% or URV)	:	2*M
118	Cutoff (%)	:	2*M
125	High Alarm %	:	4
126	Low Alarm %	:	4
131	Alarm Hysteresis %	:	4
	Exit	:	0

Flow Units		Totalizer Units or Pulse O/P Units
Special**	Gal/m	Special**
l/s	Gal/h	l
l/m	MGD	m ³
l/h	ft ³ /s	Gal
MLD	ft ³ /m	ft ³
m ³ /s	ft ³ /h	MI
m ³ /m	Ugal/s	
m ³ /h	Ugal/m	
m ³ /d**	Ugal/h	

*Only affects Fwd, Rev, Net totalizers and Pulse Output

**These units are not displayed

7.0 Outputs		
70	Output 1	: 3
71	Output 2	: 3
72	Output 3	: 3
371	Remote Comm Port Function	: R
143	Settings	: 2+
73	Modbus Address	: 4+
	Exit	: 0

Output 1	Output 2
Off	Off
On	On
Pulse Fwd	Pulse Rev
Pulse F+R	Fwd
	Rev

Output 3
(Alarm Output)

Off
On
AL-NO
AL-NC

8.0 Pressure Transducer Setup		
178	Pressure FSD Bar	: 4
176	Mode	: 4
255	Offset (mm)	: 4
257	Pres. Response Time	: 4
193	Span Trim	: 4
194	Zero Trim	: 4
196	Cal. Date	: 4
197	Cert. No.	: 4
179	Factory FSD (mV/V)	: 4
180	Factory Zero (mV@3V)	: 4
186	First Fact. Cal.	: 4
187	Last Fact. Cal.	: 4
188	Cert. No.	: 4
	Exit	: 0

9.0 Flow Calibration		
30	Profile Factor :	4*
31	Insertion Factor :	4*
32	Probe Pipe Bore (mm) :	4*
102	Mode :	4M
256	Flow Response Time :	4M
25	Flow Span Trim :	4M
26	Flow Zero Trim (0.01mm/sec) :	4M
27	Cal. Date :	4M
28	Cert. No. :	4M
	Exit :	4

*Shown only if sensor is an insertion probe (AquaProbe).

11.0 Logger		
166	Logger 1 Interval (s) :	4
168	Logger 2 Interval (s) :	4
405	Totaliser Logging Hour :	4
	Exit :	0

10.0 Tariff Control		
42	Daily Cycle Start Time :	4M
43	Daily Cycle End Time :	4M
44	Weekly Cycle Start Day :	4M
45	Weekly Cycle End Day :	4M
46	Yearly Cycle Start Date :	4M
47	Yearly Cycle End Date :	4M
40	Mode :	4M
41	Units :	4M
	Exit :	0

Note. See page 16 for notes on tariff control.

3.2 GSM /GPRS Option

Note. Menus 12.0, 13.0 and 14.0 are shown only if the GSM Option is fitted.

12.0 GSM Comms Settings		
368	GSM Module Status :	4
367	SIM Access Lock :	4
357	SIM ID Number :	4
355	SIM Password :	4
366	Network :	4
365	Signal Log (new -> old) :	4
354	Signal Test Wait Time(s) :	4
358	Manual GSM Session :	4
Periodic Wakeup Settings		
351	WakeUp Base Time :	4
347	WakeUp Base Day :	4
353	WakeUp Schedule :	4
352	WakeUp Duration :	4
	Exit :	0

13.0 SMS Services		
362	Auto Report Phone No. 1 :	4
382	Auto Report Phone No. 2 :	4
391	Auto Report Phone No. 3 :	4
Text Auto-Reports		
394	Destination :	4
361	Text Report Schedule :	4
363	Command String :	4
Flow / Pressure Log Auto-Reports		
395	Destination :	4
388	Flow Report Schedule :	4
385	Flow Report Units :	4
389	Pressure Report Schedule :	4
386	Pressure Report Units :	4
Totaliser Auto-Reports		
400	Destination :	4
399	Totaliser Report Schedule :	4
Alarm Auto-Reports		
401	Destination :	4
402	Alarm Reports Enabled :	4
	Exit	0

14.0 WITS Settings					
661	GPRS Connection	:	R	1	Flow Sensor
680	TCP Connection	:	R		I.D.
663	Connection Type	:	R	207	Transmitter
662	Connection Schedule	:	R		I.D.
433	GPRS Connect Now	:	4	423	WITS Logging Settings
	WITS Master Connection Settings				Fast Scan Rate / Legacy SMS
431	APN Access Point	:	4	559	Flow Log Interval (mins)
429	APN username	:	4	560	Pres Log Interval (mins)
430	APN password	:	4	657	Logger First Record Time
682	Master Default IP Addr	:	4	658	Logger Last Record Time
683	Master Default IP Port	:	4	659	WITS Last Log Time (Flow)
434	Main Master IP Addr	:	4	660	WITS Last Log Time (Pres)
437	Standby Master IP Addr	:	4		Flash OTAP Settings
440	Recovery Master IP Addr	:	4	211	Serial No.
443	Master IP Port No.	:	4	424	URL Directory
444	Master DNP3 Address	:	4		Exit
	WITS Field Device Settings				
447	DNP3 Address	:	4		
432	Connection Timeout (sec)	:	4		

4 Tariff Control

Notes on Tariff Control:

- The Tariff Control menu is used for defining Tariff A only.
- Tariff B is always the opposite of Tariff A.
- Daily Cycle Start Time defines the start of normal day time.
- Weekly Cycle Start Day defines the first day of the weekend (from 00:00). Weekly Cycle End Day defines the first day of the week (at 00:00).

For example, for a normal weekend (Saturday and Sunday only) set Weekly Cycle Start Day = Saturday and set Weekly Cycle End Day = Monday.

- To use a Yearly Cycle set Weekly Cycle Start Day = None and set Weekly Cycle End Day = None.
Yearly Cycle Start Date defines the day and month of the start of summer. Yearly Cycle End Date defines the day and month of the start of winter.

Weekly Cycle Defined		
Mode	Tariff A	Tariff B
1	Day time during weekend	Night time at weekend + day and night during week
2	Day time during week	Night time during week + day and night during weekend
3	All day times	All night times
4	Night time during weekend	Day time during weekend + day and night during week
5	Day and night during weekend	Day and night during week
6	Day time during week + night time during weekend	Night time during week + day time during weekend
7	All day times + night time during weekend	Night time during week

Yearly Cycle Defined (Weekly Cycle = None)		
Mode	Tariff A	Tariff B
1	Day time during summer	Night time during summer + day and night during winter
2	Day time during winter	Night time during winter + day and night during summer
3	All day times	All night times
4	Night time during summer	Day time during summer + day and night during winter
5	Day and night during summer	Day and night during winter
6	Day time during winter + night time during summer	Night time during winter + day time during summer
7	All day times + night time during summer	Night time during winter

5 Wireless Communications – GSM / GPRS versions only

5.1 Access via GSM

Commissioning test for signal strength

This provides a means of performing a radio signal test for selecting the optimum location for the antenna. The system can be tested in its final commissioned location and state – for example, manhole cover closed and any local communications equipment disconnected from the meter.

Menu 12 controls the GSM features.

Select Menu 12 and select the Signal Test Wait Time [>354]. Enter the time in seconds that the system waits before starting the signal test. A countdown starts from the selected Wait time to zero and is shown on the display. At this point close up the installation into its commissioned state. When the count reaches zero, a radio signal strength measurement is taken and the result is shown on the display for 30 seconds (long enough to open the door or meter cover to inspect the result).

The highest signal strength is represented by a value of 31; the poorest strength is a value below 5.

For reliable GPRS communication, the value should be above 12.

5.2 SIM Requirements

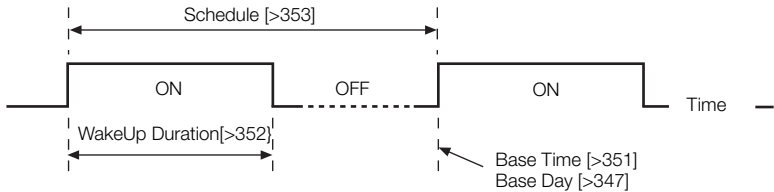
Voice enabling is not required for AquaMaster 3 operation but SMS text must be enabled. For the WITS option, GPRS data connection must be enabled with both private access point name and public domain internet access configured – see Section 7, page 27.

5.3 GSM WakeUp Control

5.3.1 Battery-Powered Meters / Renewable Power Source Offline

SMS Logging Version

To conserve power, the GSM radio module is normally powered down. To operate remote communications (SMS Requests, Auto Report or GPRS WITS), the GSM radio module can be woken either by going to menu 12 and requesting a Manual Wakeup [>358=1] – which forces the module to wake up for the WakeUp Duration [>352] – or by setting a programmable WakeUp schedule as shown in the following diagram:



The WakeUp Schedule [>353] can be programmed for wake ups every 15 / 30 / 60 minutes, 2 / 6 / 12 / 24 hours, Always On or Always Off. The Base Time [>351] sets the time of day for the wake ups. The Base day [>347] sets the day of the week for the Auto Reports.

As the GSM operation consumes significant amounts of power, the battery life or internal backup times are shortened significantly if the GSM engine is programmed ON more than once per day or the ON time is set > 3 minutes.

WITS Logging Version

For GPRS WITS versions, the connection schedule is controlled by the WITS Master device, as set by the contents of the WITS incremental configuration file (ICF) – see Section 7, page 27. On a periodic connection schedule with mains power off, the GSM / GPRS connection powers down as soon as possible after completion of a WITS DNP3 session. To maximize battery life, set the WITS connection schedule to every 4 hours or longer.

5.3.2 Mains Powered Meters / Renewable Power Present

When the meter is mains-powered or renewable power is present, the GSM / GPRS radio module is powered continuously and is able to handle remote communications (SMS Requests, Auto Report or WITS DNP3). If power is interrupted and the meter is powered from its internal back-up, the GSM module does not operate continuously.

Note. On mains-powered GSM units the module is rebooted automatically once every day. This process takes approximately 1 minute during which communication is not possible.

5.4 WakeUp Duration (SMS Logger Only)

The power supply to the transmitter may have been ordered as one of the following types:

- Mains with backup
- Battery-only
- Renewable energy
- Mains with backup and external battery

For mains-powered transmitters with backup, the WakeUp Duration does not apply as the GSM module is powered continuously while there is mains power present.

For battery, renewable energy and mains-powered units on backup operation, the WakeUp Duration (>352) has a range of 3 to 30 minutes.

5.5 Status

5.5.1 GSM Module Status

GSM Module Status [>368] shows the current GSM radio module status as one of:

- 0 = Not Configured
- 1 = Off
- 2 = Low Power Recovery Mode
- 3 = Powering Up
- 4 = Off (SIM not fitted)
- 5 = Ready
- 6 = Waiting PIN
- 7 = Waiting PUK
- 8 = Waiting Antitheft PIN
- 9 = Waiting Antitheft PUK
- 10 = Waiting PIN2
- 11 = Waiting PUK2
- 12 = SMS Mode
- 13 = Command Handling
- 14 = Connecting
- 15 = Connected
- 16 = Disconnecting
- 17 = Off (powerup fail)
- 18 = Off (low power)
- 19 = Triggered Reset
- 20 = Triggered Reboot

5.5.2 Signal Strength (current value)

The Signal Strength parameter [>348] may be used to obtain the radio signal strength on demand.

For example, >348<0>=16

5.5.3 Signal Log (Signal Strength History)

A signal strength reading is taken each time the module is powered up (or daily for a mains-powered, non WITS transmitter). The last 7 signal strength readings can be examined using Signal Log in Menu 12 [>365]. The most recent reading is to the left.

In this example 16 is the most recent reading:

<0>365=16 14 14 13 12 14 14

5.6 Access via SMS Text Message

A transmitter with the GSM option also provides a means of accessing AquaMaster 3 data via SMS text messaging. An SMS Request Text can be sent from a mobile phone to AquaMaster 3 and an SMS Reply Text with the requested information is sent to the originating phone or SMS gateway. If the AquaMaster 3 is battery- or external renewable energy-powered, the SMS Request is not serviced until the next programmed WakeUp time as defined in Menu 13 or the WITS connection schedule.

5.6.1 SMS Request Message

SMS Request messages must have the following format:

+password;command;command;...;command;

Where:

+password is the character + followed by the AquaMaster 3 login password [>248] and the command may be:

Either:

Any of the AquaMaster 3 Parameter Access Commands:

FLW	Rate Of Flow
VEL	Rate Of Velocity
PRS	Pressure
ALM	Alarm
TOF	Total Volume Forward
TOR	Total Volume Reverse
TON	Total Volume Net
TFA	Tariff A
TFB	Tariff B
TIM	Time and Date

Or:

any regular Command Line Interface requests

for example: >365

to show the last 7 Signal Strength readings.

Example

Sending:

+user;FLW;PRS;TOF;TFA;TIM;>365;

results in a reply similar to:

-AquaMaster 3; ABB01M; Flow=-157.93 l/s; Pressure=-0.619765 Bar; TOT Fwd=16853 m3; TRF A=1866 m3; TIME=00:00:01 08-07-03;<0>365=14 14 14 13 12 14 14;

5.7 SIM Access Control

This section describes the steps to change the GSM module's SIM PIN and Access Lock status. Because SIM Access Lock and SIM PIN are both held in the SIM they can also be changed by inserting the SIM into a mobile phone and following the steps to change it, usually found in phone setting security menus. However, where the AquaMaster 3 is potted the SIMs may not be able to be removed and security setup can then only be achieved via the AquaMaster 3.

SIM and PIN access via the AquaMaster 3 first require that the user has logged in at level 4. Because these features are related to the security of the SIM it is recommended that the customer changes the level 4 password from the default setting. This can be achieved via menu 4.

Note. The PIN can be changed only via the local computer connection. It cannot be changed via GSM.

5.7.1 Access Lock

When the SIM Access Lock is enabled, the PIN must be sent to the SIM each time the GSM module is powered up. Once the PIN has been accepted the SIM can be accessed as normal.

If an incorrect PIN is sent to the SIM, a number of retries are permitted (SIM dependent, but usually a further two attempts). If no correct PIN was received by the module in this time, the SIM is locked and can be recovered only with its PUK (a one-time unlock key that is obtained from the SIM's service provider).

5.7.2 PIN

The PIN is the password required to access the SIM if the Access Lock is enabled. If AquaMaster 3 detects that the GSM module requires a PIN for access, it sends the string that has been set up to use in SIM Password [>355].

If AquaMaster 3 has not had the SIM Password set or if the password is incorrect, the GSM Module Status [>368] reports *Waiting PIN* or a similar message when the GSM module is powered up.

[If the SIM Password is '-' no string is sent to the GSM module – it is not possible to have an empty variable string in the AquaMaster 3 menu]

When viewed, the SIM Password displays the actual PIN string for login levels 4 (and above – note that login levels above 4 are not detailed in this guide.). For login levels 3 and below it is displayed as a number of asterisks (*) – one asterisk for each digit of the PIN.

Setting AquaMaster 3 to use a SIM's Existing PIN

Change the SIM password to the PIN of the SIM card.

AquaMaster 3 automatically uses this password to send to the GSM module each time it powers the module up. If the password is incorrect the SIM eventually becomes locked out.

5.7.3 Using AquaMaster 3 to Change a SIM's PIN

1. Change SIM Password using the format:
<oldpin>,<newpin>
2. The new PIN can be viewed in SIM Password.
3. The GSM module is re-booted (takes approximately 1 minute). Once it has rebooted, the GSM Module Status should report that the module is 'Ready'.

5.7.4 Using AquaMaster 3 to Change a SIM's Access Lock Status

This requires that the PIN has already been configured.

Cycle through options via menu item SIM Access Lock [>367]. Using the command line, this parameter can be set to value 0 for 'Lock Disabled' or 1 for 'Lock Enabled'.

If the AquaMaster 3 does not have a PIN to use, it is not possible to request the SIM Access Lock status and this is reported as '?' or value 2.

5.7.5 Using AquaMaster 3 to Unlock a SIM when a PUK is needed

If a SIM has been 'locked out' through repeated attempts to access with an incorrect PIN the GSM Module Status reports *Waiting PUK* or a similar message. The required PUK can be obtained from the SIM's service provider.

1. Change SIM Password using format:
<puk>,<newpin>
2. The new PIN can be viewed in SIM Password.
3. The GSM module is re-booted (takes approximately 1 minute). Once it has rebooted, the GSM Module Status should report that the module is 'Ready'.

Note. The SIM password cannot be changed via a remote port.

5.8 Auto Reports (SMS Logger Only)

This feature sends information via SMS text messages from an AquaMaster 3 to a programmed number on a regular schedule. The Base Time and Day used for the scheduling are the same as those used for the WakeUp system.

Other control parameters are located in Menu 13 – see page 14.

5.8.1 Auto Report Phone No 1 (or 2 or 3)

AutoReport SMS text messages can be sent to any one of three SMS telephone numbers, designated as Auto Report Phone No 1, Auto Report Phone No 2 and Auto Report Phone No 3. Enter telephone numbers as they would normally be dialled, with no spaces, using either the full international format (for example, +441453123456 or 00441453123456) or the area code and number (01453123456), as appropriate.

Each type of Auto Report has its own section of the menu for configuration and can be sent to either the same number or to different numbers. These are selected by the Destination parameter in each section as Phone No. 1, Phone No. 2 or Phone No. 3.

5.8.2 Text Auto-Reports

The AutoReport message is defined in AR Command String [>363]. This uses commands from the AquaMaster 3's Parameter Access command set.

for example: >363=TON;TFA;

This sets up AutoReport to send the Net Total and the Tariff A Total.

5.8.3 Text Report Schedule

The Text Report schedule (>361) can be set to any one of the following options:

- 0 Off
- 1* 30 minutes (on the 1/2 hour)
- 2* 1 hour (on the hour)
- 3* 2 hours (on the 'even' hour)
- 4 Daily (every day at WakeUp Base Time)
- 5 Weekly (every WakeUp Base Day at WakeUp Base Time)
- 6 Monthly (1st day of each month, at WakeUp Base Time)
- * These options are functional only for mains-powered units; while on battery power, these options behave as 'Off'.

5.8.4 Flow and Pressure Log Auto-Reports

SMS messages containing Flow and / or Pressure data from Logger 1 for the previous 24 hours can be sent automatically by the AquaMaster 3 to one of the three specified phone numbers.

If a schedule for Flow Log Reports is set and if Logger 1 is set to a 15 minutes logging interval, the last 24 hour's flow data is contained in a single SMS message. If a shorter interval is specified and therefore there are more data points in the log, the amount of data may require multiple messages to be sent.

Similarly, if a schedule for Pressure Log Reports is set, then separate message(s) containing Pressure Data are sent to the same phone number.

Flow Report Units (>385) and Pressure Report Units (>386) specify the engineering units used in the reports. Pressure Reports always give the pressure in gauge units.

5.8.5 Flow and Pressure Report Schedules

The Flow Report Schedule (>388) and Pressure Report Schedule (>389) can be set to either of the following options:-

- 0 Off
- 1 Daily (every day at WakeUp Base Time)

5.8.6 Totalizer Auto-Reports

If enabled this report sends the instantaneous values (at the WakeUp Base Time) of all the totalizers in the transmitter (Forward, Reverse, Net, Tariff A, Tariff B).

5.8.7 Totalizer Report Schedule

The Totalizer Report Schedule (>399) can be set to any one of the following options:

- 0 Off
- 1 Daily (every day at WakeUp Base Time)
- 2 Weekly (every WakeUp Base Day at WakeUp Base Time)
- 3 Monthly (1st day of each month, at WakeUp Base Time)

5.8.8 Alarm Auto-Reports

This controls the sending of a report if any one or more of these events occur:

- A sensor error
- A coil error
- A mains failure alarm
- A battery alarm
- A high or low flow alarm

If the Alarm Reporting (>402) has been enabled then, on any of the above errors, an immediate alarm report is generated and sent via GSM to the phone number referred to in Destination (>401). This is provided there has been no Alarm Report sent out during the last 24 hours (no alarm flag present) and more than 24 hours has passed since start-up.

Regardless of the GSM Wake-up time, the GSM module is triggered and the report is sent. If the alarm flag is still present at the time of a scheduled text auto-report, the alarm field is appended at the end of the Auto-Report; regardless of whether it is already included in the 'Command String'.

If Alarm Reporting (>402) has been disabled, no report is generated.

6 Alarm Information

Table 6.1 details AquaMaster 3 alarm conditions, showing each alarm's numeric value and whether it affects the alarm output O/P3. Alarm Code [>290] provides a numeric sum of AquaMaster 3's active alarm conditions. Table 6.1 may be used to determine which alarms are active by process of subtraction of the next highest alarm values.

Example: Alarm Code shows value 81,920.

Next highest alarm value = 65,536 => Alarm 16, High Flow

Subtract: 81,920 – 65,536 = 16,384

Next highest alarm value = 16,384 => Alarm 14, Mains Fail

Subtract: 16,384 – 16,384 = 0 (all done).

Alarm output O/P3 may be set up via Output 3 [>72] – see menu 7.0 Outputs (page 12) and the User Guide (OI/FET2XX–EN) for wiring details.

Alarm No.	Value	Alarm	O/P3 ?
0	1	ABB internal alarm 0	N
1	2	ABB internal alarm 1	N
2	4	ABB internal alarm 2	N
3	8	High DC voltage (any power type)	N
4	16	ABB internal alarm 4	N
5	32	High DC voltage (battery power)	N
6	64	MID (read only) switch	N
7	128	External battery warning	N
8	256	Not used	N
9	512	Sensor comms. fault	N
10	1,024	External battery fail	Y
11	2,048	Sensor not connected	Y
12	4,096	Coil not connected	Y
13	8,192	Empty pipe	Y
14	16,384	Mains failure	Y
15	32,768	High dc voltage (alarm)	Y
16	65,536	High flow	Y
17	131,072	Low flow	Y
18 to 29	-----	Not used	–
30	1,073,741,824	ABB internal alarm 30	N

Table 6.1 AquaMaster 3 Alarm Values

7 Water Industry Telemetry Standard (WITS)

7.1 Overview

WITS is an open standard based on the DNP3 Protocol. DNP3 provides generic mechanisms for the enhancement of the protocol to add functionality and WITS takes advantage of this to extend DNP3 to provide standardized functionality.

AquaMaster 3 is a remote field integrated solution containing flow and pressure measurement with a WITS compatible data logger and GPRS data connectivity to enable it to communicate with any WITS compatible Master. AquaMaster 3 implements WITS Protocol Version 1.1, 1.2 and 1.3 and DNP Secure Authentication V2.

The WITS functionality of AquaMaster 3 is available only for transmitters ordered with the 'GW' WITS option.

All WITS devices are supported with a device profile XML file, a bulk configuration file (BCF) and an initial incremental configuration file (ICF); these specify the WITS features supported by the device and their associated configuration files and are required for WITS Master configuration. The Profile, BCF and ICF for ABB AquaMaster 3 are available as a zip package from www.abb.com. Click on, or search for, '[AquaMaster 3 WITS support files](#)'

7.2 GPRS WITS System Architecture

AquaMaster 3 communicates remotely using GPRS and SMS technology, with the system architecture shown in Fig. 7.1.

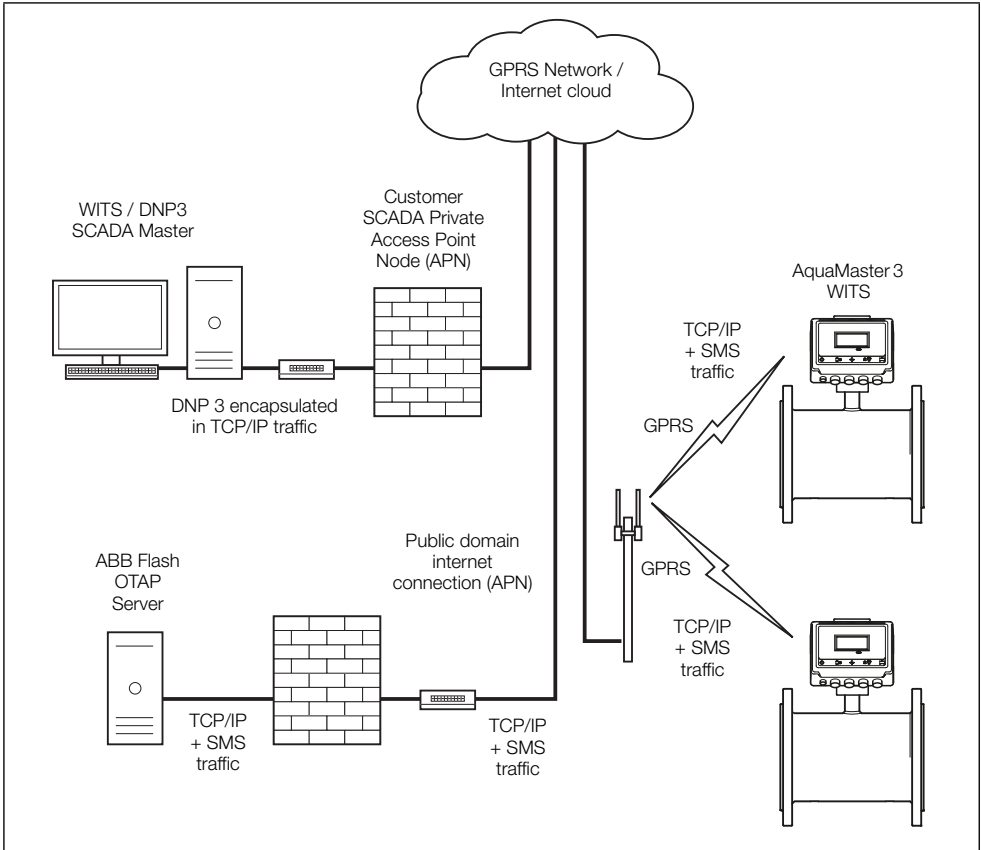


Fig. 7.1 WITS System Architecture

The WITS SCADA Master must be located behind a secure private access point node (APN) at the URL programmed using the APN username and passwords entered into the AquaMaster 3 for authentication (see URL / APN configuration on page 30). When AquaMaster 3 makes a scheduled connection through the APN to the Master, using the pre-programmed Master IP address / port number (see Section 7.4, page 31), a TCP/IP Socket connection is established. A DNP3 connection is then established to the Master at the set DNP3 Address (see Section 7.5, page 31). AquaMaster 3 then transmits a DNP3 Null unsolicited message to initiate DNP3 / WITS Communication. The SIM must be enabled to access this private APN.

AquaMaster 3 supports remote firmware updates (OTAP) under ABB's control. To use this feature, enable the SIM for public domain internet access (see Section 7.3, page 29) and International SMS. If a firmware update is required, contact ABB UK service with the device details, the device Serial no (>211), the OTAP Directory (>424) and the fitted SIM SMS phone number. ABB can then upgrade the AquaMaster's firmware remotely.

7.3 GPRS and Access Configuration

A GPRS-enabled SIM must be fitted and enabled for both public domain internet access and the private network access point node (APN) behind which the firewall-protected WITS Master is connected. The public domain internet access is required to support AquaMaster 3 firmware updates from ABB servers. If the SIM's GPRS connection is not suitably enabled, the remote flash update service will not be available.

For internet access by AquaMaster 3, the following information must be entered / configured:

- Network operator ID code (OID), also known as an international mobile subscriber identity code (IMSI) – this is available from your network provider or via an internet search (for example, Vodafone = 23415).
- Access point node (APN) – this is available from your network provider (for example, Vodafone = internet)
- User name (USR) – this is available from your network provider (for example, Vodafone = web)
- Password (PWD) – this is available from your network provider (for example, Vodafone = web)

The above is entered in a special format using the command line interface using variable number 425 as follows:

```
>425=Sn,elem,value
```

where:

'Sn' = slot number

'elem' is one of 'OID', 'APN', 'USR', 'PWD'

'value' is the relevant value of the chosen 'elem'.

AquaMaster 3 supports four slot numbers. Your SIM GPRS configuration can be entered into any slot. It is important that GPRS settings are used, NOT those for WAP.

The following are typical examples for some mobile networks:

Slot 0. Vodafone

>425=S0,OID,23415
>425=S0,APN,internet
>425=S0,USR,web
>425=S0,PWD,web

Slot 1. O2

>425=S1,OID,23410
>425=S1,APN,mobile.o2.co.uk
>425=S1,USR,mobileweb
>425=S1,PWD,password

Slot 2. Orange

>425=S2,OID,23433
>425=S2,APN,orangeinternet
>425=S2,USR,user
>425=S2,PWD,pass

The above settings can be queried by entering '?' for the 'value'.

Most WITS Masters are installed behind a private access point node (APN) for IP security reasons. AquaMaster 3 must be configured with a username and password to enable a TCP/IP connection to be established to the WITS Master. These can be configured by logging in at Level 4, navigating to the WITS Settings Menu and using 'space' to alter / set the following parameters:

APN access point = URL of access point (for example, www.acmewaterutility.com)

APN username = username (for example, abcde)

APN password = password (for example, q3d7h)

The SIM phone number must be entered in variable number >448 (for example, >448=+44708123456)

For over-the-air (GPRS) flash firmware updates (OTAP) from ABB servers, the remote server URL directory must be set. This is normally factory-configured and should not be altered. It can be viewed / altered at the end of the WITS Settings menu:

Flash OTAP Settings

Serial No for example, 3K220000123456 (factory set)

URL directory for example, \downloads\acmewaterutility

In order to use the remote OTAP, contact ABB Service and provide the following information:

Meter phone Number (>448)

Meter Serial Number from Flash OTAP Settings above (>211)

7.4 Master Connection Configuration

WITS connections are via TCP/IP and require IP address and IP port number to be set. AquaMaster 3 supports static IP only and does not support DNS. It supports up to 3 servers:

- Main server
- Standby server
- Recovery server

AquaMaster 3 will attempt connection with the main server and switch to standby or recovery if no response is obtained from the main server. Once connected, a WITS incremental configuration file can be sent from the Master to reconfigure the IP address and port number for each of the above server settings.

Note. The same IP port number must be used on all 3 servers.

The above is configured by logging in at level 4 and navigating to the WITS setting menu and setting:

Master Default IP Addr	for example, 10.44.81.123
Master Default IP Port	for example, 4000
Main Master IP Addr	for example, 10.44.81.123
Standby Master IP Addr	*
Recovery Master IP Addr	*
Master IP Port No	for example, 4000

* Typically configured automatically by the Master via a BCF + ICF sequence. The action associated with a BCF copies the contents of 'Master Default IP Addr.' into the Main, Standby and Recovery Master IP Address fields. The Master IP Port No is also copied from the 'Master Default IP Addr'. The Master originated ICF should reconfigure the Main, Standby and Recovery IP Address to the required addresses.

Note. Although the items marked '*' can be configured locally or via SMS, this should only be used to recover communications if the 'Master Default' information is accidentally set incorrectly, in which case communication with the Master will be lost when a BCF is processed by the AquaMaster 3.

7.5 DNP3 Setup

To prepare the AquaMaster 3 DNP3 connection, configure the WITS Setup Menu as follows:

Master DNP3 Address	for example, 3
---------------------	----------------

WITS Field Device Settings

DNP3 Address	for example, 52999
Connection Timeout (sec)	This is the inactivity time, after which the DNP3 connection will be terminated. Typically set to 100 sec

Note. The field device port number used is the same as set by 'Master IP Port No.'

7.6 WITS Protocol Configuration

AquaMaster 3 supports WITS Protocol Versions 1.1, 1.2 and 1.3 but is factory-configured to use WITS Version 1.1 by default. To change the WITS protocol version, log on to level 4 and set variable >436 (WITS Minor version) to:

- | | |
|--------------------|------------------|
| >436 = 1 (default) | WITS Version 1.1 |
| >436 = 2 | WITS Version 1.2 |
| >436 = 3 | WITS Version 1.3 |

After changing versions, the AquaMaster 3 restarts automatically.

AquaMaster 3 also supports a factory-configured option of totalizer DNP3 analog input real point support (see Appendix A). Forward, reverse and net totals are available in the programmed volume unit communicated in a signed 32 bit format, scaled x100. With suitable scaling at the Master, the volume is available with 2 significant digits (for example, ±nnnnnnnn.xx).

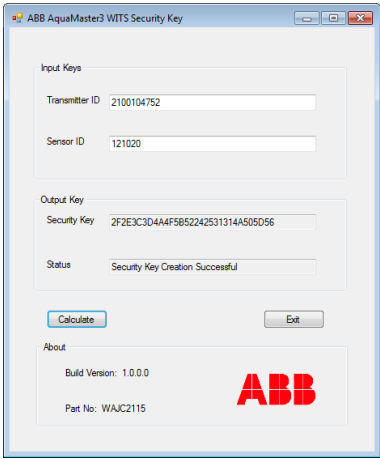
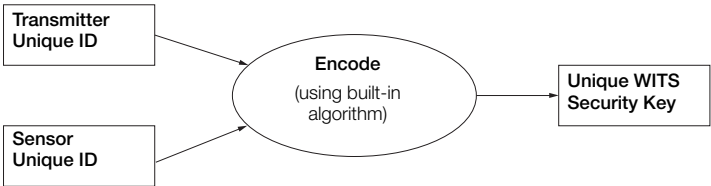
7.7 Master Secure Authentication Configuration

AquaMaster 3 WITS implementation can be used with or without DNP3 Secure Authentication V2. This is configured by logging on to level 4 and setting variable >644:

- >644 = 0 DNP3 Secure Authentication V2 Off
- >644 = 1 (default) DNP3 Secure Authentication V2 On

With secure authentication, the WITS Master requires a unique update key to be generated for each AquaMaster flowmeter. ABB provide a dongle-protected utility (contact ABB) that calculates a unique key from two flowmeter specific keys:

- Transmitter ID (>207)
- Sensor ID (>1)



The unique WITS update key for each flowmeter must be entered into the Master configuration.

Note. If either the AquaMaster 3 transmitter or sensor are replaced, this key must be recalculated and updated in the Master.

7.8 Logger Configuration

AquaMaster 3 supports a high-speed sample data log (configurable typically 1 min) as well as an archive logger (configurable typically 15 mins) for both flow and pressure. If the AquaMaster 3 is configured to use WITS Version 1.3 (see Section 7.6, page 32) the high-speed sample data log can be downloaded by a request from the Master.

The fast scan custom log can be configured at a rate of:

- 60 sec (main log max capacity = 20.67 days)
- 90 sec (main log max capacity = 31 days)
- 180 sec (main log max capacity = 62 days)

This is configured by logging in at level 4 and navigating to the WITS Setting menu **WITS Logging Settings**

Fast Scan / Legacy SMS : enter space bar to cycle through selection.

Note. Setting to 0 turns off WITS functionality and the transmitter reverts to a non-WITS SMS logger.

7.9 WITS Operation

The AquaMaster 3 is an IP originating endpoint only; user requests and configuration changes are queued in the Master and are processed when the AquaMaster 3 makes a scheduled Master connection. The connection behavior depends on the type / status of the transmitter's power supply.

- 1. **Mains power on**
At the time of the scheduled connection, a GPRS TCP / DNP3 connection is made, data transferred and the connection closed.
- 2. **Non-mains power or mains power off**
Connection is periodic. Not only is the TCP / DNP3 non-permanent, the GPRS connection is terminated at the end of each communication session and re-established at the time of the scheduled connection. Connection Type is shown as 'Periodic' or 'Emergency' (see below).

The state of the connection and its type can be viewed using menu **14 WITS Settings**:

Setting	Example status
GPRS Connection:	Closed
TCP Connection:	Closed
Connection Type:	Periodic
Connection Schedule:	Normal

If the device has insufficient power, (for example, the battery is flat, or the mains power supply has failed and limited standby power is available), the connection schedule reverts to 'Emergency mode'; the WITS SCADA defined connection schedule is ignored and a connection is made only once each day to preserve what little energy is left.

The connection schedule is downloaded via a WITS Incremental Configuration file (ICF) from the Master.

Note. If a battery-powered transmitter is used, do not set a frequent connection schedule as this will severely limit battery life. For example, a 15 minute connection schedule is suitable only for mains-powered or renewable energy versions. Best practise is to enable the WITS Master to reconfigure the connection schedule based on the flowmeter's available power source. For example, if mains power is lost, the WITS Master can send an ICF to set a 12 hour connection schedule. AquaMaster 3 sends alarm events to the Master informing it of changes to the AquaMaster 3's power state, so the AquaMaster 3 power state is always known to the Master.

The state of the WITS logger records can be viewed using menu **14 WITS Settings**:

Setting	Example status
Flow Log Interval (mins):	15
Pres Log Interval (mins):	15
Logger First Record Time:	FRT: 09:05:00 07/06/2014. (Note. First sample in fast log)
Logger Last Record Time:	LRT: 13:04:30 12/06/2014. (Note. Last sample in fast log)
WITS Last Log Time (Flow):	LT0: 13:00:00 12/06/2014
WITS Last Log Time (Pres):	LT1: 13:00:00 12/06/2014

Note. If the WITS Master is being updated, the LT0 and LT1 time will be approximately within the Log interval of the current time. If the Master is not being updated, LT0 and LT1 are set initially to the starting log time.

Appendix A

A.1 DNP3 Analog Input Real Points

A summary of all real point data is described in Table A.1.

Data Point Category	DNP3 Group No.	DNP3 Variation	Point No.	ABB VDB Ref.	Description
A	30	5*	0	462	Flow rate
A	30	5*	1	463	Pressure
B	30	5*	2	217	Flow rate (instantaneous)
B	30	5*	3	222	Pressure (instantaneous)
B	30	5*	50	234	Left electrode resistance
B	30	5*	51	235	Right electrode resistance
B	30	5*	60	340	Power external status
B	30	5*	61	376	Power voltage external
B	30	5*	62	377	Power voltage internal 3V8
B	30	5*	63	378	Power voltage internal 3V2
B	30	5*	70	243	Coil current
B	30	5*	71	328	Signal A electrode voltage
B	30	5*	72	329	Signal B electrode voltage
B	30	5*	80	348	GSM signal level quality
B	30	1**	90	700	Totalizer forward x100 (see Note.)
B	30	1**	91	701	Totalizer reverse x100 (see Note.)
B	30	1**	92	702	Totalizer net x100 (see Note.)

* Float single precision format

** 32 bit signed integer format

Table A.1 DNP3 Group / Variation / Points Summary

Note. Totalizer real data points are available only if the optional totalizer is ordered.

A.2 DNP3 Analog Input Virtual Points

Data Point Category	DNP3 Group No.	DNP3 Variation	Point No.	ABBVDB Ref.	Description
A	30	5	10	456	Flow rate minimum
A	30	5	11	457	Pressure minimum
B	30	5	20	458	Flow rate maximum
B	30	5	21	459	Pressure maximum
B	30	5	30	460	Flow rate mean
B	30	5	31	461	Pressure mean

Table A.2 WITS Group / Variation / Virtual Points Summary

A.3 DNP3 Analog Input Strings

Data Point Category	DNP3 Group No.	DNP3 Variation	Point No.	ABBVDB Ref.	Description
C	110	0	0	366	GSM network
C	110	0	1	1	Flow sensor ID
C	110	0	2	17	Flow sensor contract number
C	110	0	3	33	User sensor tag number
C	110	0	4	207	Transmitter unique ID
C	110	0	5	209	Contract number
C	110	0	6	212	Transmitter tag

Table A.3 DNP3 Analog Input Strings Summary

A.4 Signals to be Logged in SCADA

AquaMaster 3 logs data-point category 'A' SCADA data (flow rate and pressure) for presentation in a WITS log file. Table A.4 illustrates the IC supported. Virtual points are logged if on-scan and if the corresponding real point is also on-scan. Category B are not logged; only on / off scan configurations.

					WITS Incremental Configuration Record Types																
DNP3 Group No.	DNP3 Variation No.	Point No.	Description	ABB VDB No.	1000 – Point On/Off Scan	1001 – Override Point	1002 – Anal. Range Scaling	1003 – Analog Limit	1004 – Counter Limit	1005 – Point Archive	1006 – Binary Status	1007 – Profiles	1008 – Rate of change	1009 – Object Action Flags	1010 – Minimum	1011 – Maximum	1012 – Mean	1013 – Integral	1014 – State Counter	1015 – State Runtime	1016 – Profile Control Value
30	5	0	Flow rate	462	✓	✗	✓	4	✗	✓	✗	4	✗	✓	✓	✓	✓	✗	✗	✗	✗
30	5	1	Pressure	463	✓	✗	✓	4	✗	✓	✗	4	✗	✓	✓	✓	✓	✗	✗	✗	✗

Table A.4 Analog Input Points to be logged in SCADA

A.5 WITS Health Check Standard Bit Mask

HCDS Element 5, the WITS standard bit mask (with assert / clear actions), is defined in Table A.5.

Health-check standard bit mask					
Bit No.	Description	Asserted	by	Cleared	by
0	Supply failure (mains supply failure)	Data set event with connection request	FD	Data set event with connection request	FD
1	Battery voltage low (External Battery Voltage between 4.5 and 5 V)	Data set event with connection request	FD	Data set event with connection request	FD
2	I/O failure (no longer supported)	–	–	–	–
3	Scheduled connection occurrence	Data set event with connection request	FD	Static	FD
4	Local user device attached (Local user logged in using a terminal application. Clears when the session closes)	Data set event without connection request	FD	Data set event without connection request	FD
5	Log file filling (set at 100% full)	Data set event without connection request	FD	Data set event without connection request	FD
6	Log file has discarded some information	Data set event without connection request	FD	Data set event without connection request	FD
7	Close comms link	Static	MS	Static	FD
8	Configuration changed. AM3 sets this bit when it initializes in WITS mode for the first time. Cleared when MS activates a downloaded ICF / BCF.	Data set event without connection request	FD	Static	FD / MS
9	Device off-scan	Static	FD	Static	FD
10, 11	Highest permitted action for all points. Always set to 11	Data set event without connection request	FD	Data set event without connection request	FD
12	Reserved for WITS V1.1				
	IC parameter changed for WITS V1.2 and 1.3	Data set event without connection request	MS	Static	FD
13 to 31	Reserved for future use				

Table A.5 WITS Health-Check Standard Bit-Mask Description

A.6 WITS Health Check Vendor Mask

HCDS Element 6, the WITS vendor bit mask (with assert / clear actions), is defined in Table A.6.

Note. When quoting an HCDS bit number, the vendor specific set are 'bit 32 + n' where n is the bit no. in Table A.6.

Health-check vendor bit mask					
Bit No.	Description	Asserted	by	Cleared	by
0	ABB internal alarm 0	Data set event without connection request	FD	Data set event without connection request	FD
1	ABB internal alarm 1	Data set event without connection request	FD	Data set event without connection request	FD
2	ABB internal alarm 2	Data set event without connection request	FD	Data set event without connection request	FD
3	High DC voltage on electrodes (any power type)	Data set event without connection request	FD	Data set event without connection request	FD
4	ABB internal alarm 4	Data set event without connection request	FD	Data set event without connection request	FD
5	High DC voltage on electrodes (battery power)	Data set event without connection request	FD	Data set event without connection request	FD
6	MID (read only) switch	Data set event without connection request	FD	Data set event without connection request	FD
7	External battery warning (External battery voltage between 4.5V and 5V)	Data set event with connection request	FD	Data set event with connection request	FD
8	Not used	Data set event without connection request	FD	Data set event without connection request	FD
9	Sensor comms. fault	Data set event without connection request	FD	Data set event without connection request	FD
10	External battery fail (Ext. battery voltage below 4.5V)	Data set event with connection request	FD	Data set event with connection request	FD
11	Sensor not connected	Data set event without connection request	FD	Data set event without connection request	FD
12	Coil not connected	Data set event without connection request	FD	Data set event without connection request	FD
13	Empty pipe	Data set event without connection request	FD	Data set event without connection request	FD
14	Mains failure	Data set event with connection request	FD	Data set event with connection request	FD
15	High DC voltage (alarm)	Data set event without connection request	FD	Data set event without connection request	FD

Table A.6 WITS Health-Check Vendor Bit-Mask Description

Health-check vendor bit mask					
Bit No.	Description	Asserted	by	Cleared	by
16	High flowrate alarm	Data set event without connection request	FD	Data set event without connection request	FD
17	Low flowrate alarm	Data set event without connection request	FD	Data set event without connection request	FD
18	Supercapacitor backup low voltage warning (< 3.4V)	Data set event with connection request	FD	Data set event with connection request	FD
19 to 29	Not used	–	–	–	–
30	ABB internal alarm 30	Data set event without connection request	FD	Data set event without connection request	FD
31	Not used				

Table A.6 WITS Health-Check Vendor Bit-Mask Description (Continued)

Notes

Sales



Service



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