Setup Guide
IM/ACT/S–EN   Issue 1

Data Management Software
AutoChart for AquaMaster

ABB

ABB

The Company

We are an established world force in the design and manufacture of instrumentation for industrial process control, flow measurement, gas and liquid analysis and environmental applications.

As a part of ABB, a world leader in process automation technology, we offer customers application expertise, service and support worldwide.

We are committed to teamwork, high quality manufacturing, advanced technology and unrivalled service and support.

The quality, accuracy and performance of the Company's products result from over 100 years experience, combined with a continuous program of innovative design and development to incorporate the latest technology.

The UKAS Calibration Laboratory No. 0255 is just one of the ten flow calibration plants operated by the Company and is indicative of our dedication to quality and accuracy.

Health and Safety

To ensure that our products are safe and without risk to health, the following points must be noted:

1. The relevant sections of these instructions must be read carefully before proceeding.
2. Warning labels on containers and packages must be observed.
3. Installation, operation, maintenance and servicing must only be carried out by suitably trained personnel and in accordance with the information given.
4. Normal safety precautions must be taken to avoid the possibility of an accident occurring when operating in conditions of high pressure and/or temperature.
5. Chemicals must be stored away from heat, protected from temperature extremes and powders kept dry. Normal safe handling procedures must be used.
6. When disposing of chemicals ensure that no two chemicals are mixed.

Safety advice concerning the use of the equipment described in this manual or any relevant hazard data sheets (where applicable) may be obtained from the Company address on the back cover, together with servicing and spares information.

Contents

1 Controls and Display

This Setup Guide is applicable to product firmware version 2.20 or above. Features applicable to the GSM option are present only on version 2.30 or above. Some advanced features are present only in version 2.40 or above. To view the transmitter version number, type >0 ⏎.

When the transmitter is installed for first use, remove the protective label (if fitted) from the front to allow light to activate the transmitter.

If the instrument is not powered, connect any batteries or external supply as detailed in the Installation Manual (part no. IM/AM or IM/AM/E).

▣ **Important**. Read the manual for battery condition monitoring.
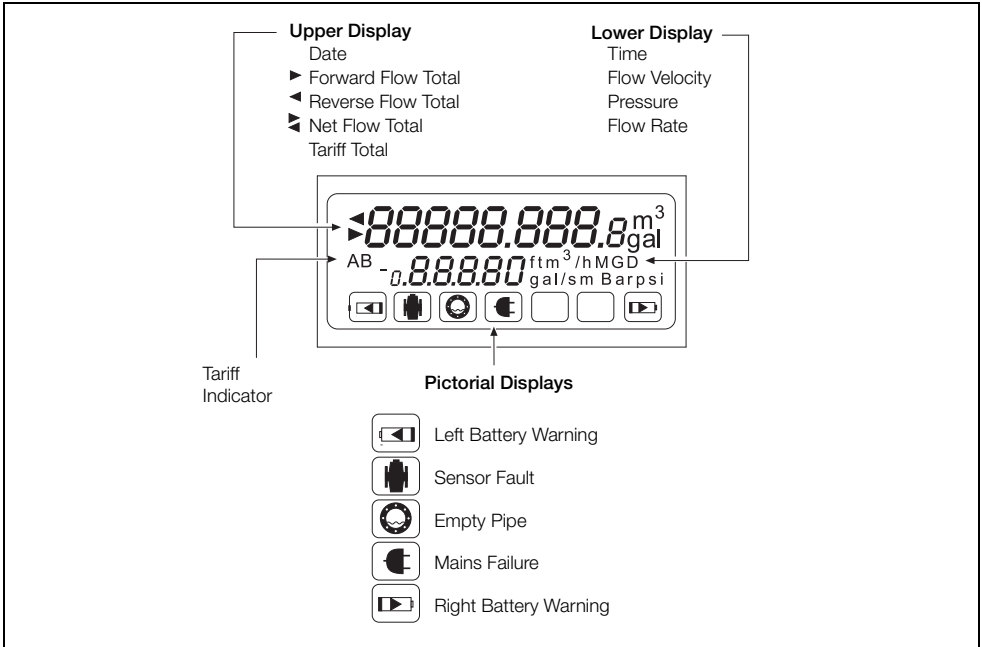
Fig. 1.1 Controls and Display

2 Programming

2.1 Setting Up the PC – HyperTerminal Setup

Example from Windows NT – other versions of Windows may vary.

1. From the Windows Start menu select Programs/Accessories/Communications/HyperTerminal.

2. At 'New connection' type 'AquaMaster'.

3. At 'Connect using' select 'COM1' or 'COM2' (depending on the PC connection)

4. At 'Port Settings' select 'Bits per second' 4800, 'Data bits' 8, 'Parity' None, 'Stop bits' 1, 'Flow control' none.
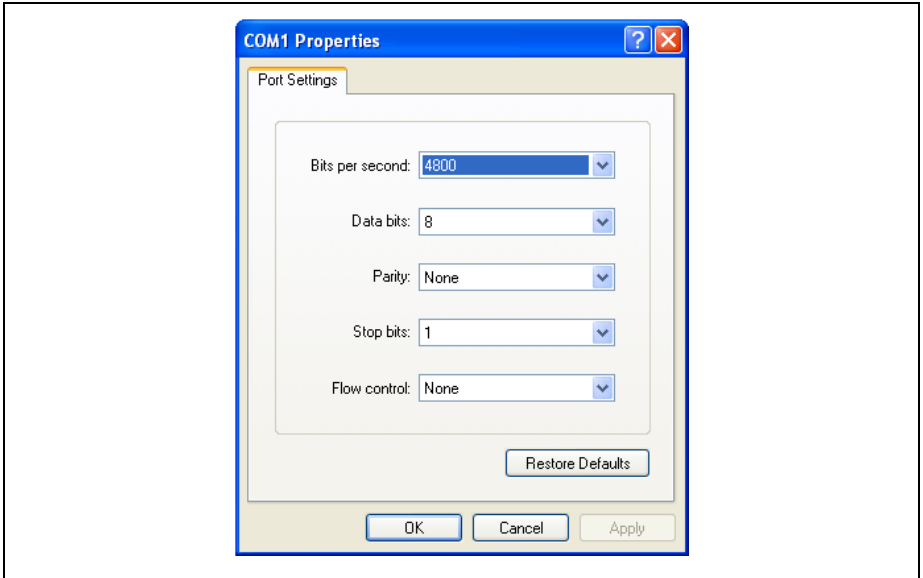
2.2 Programming the AquaMaster

To access programming mode, connect the AquaMaster to a computer via either of the serial port connections (but note that the GSM-equipped version does not have a remote port) – see Installation Manual.

1. Use serial port settings of 'Baud' 4800, 'Data bits' 8, 'Stop bits' 1, 'Parity' no.

2. Press **Tab** 5 times to activate the programming mode.

   The following display appears on the computer screen:

   – AquaMaster.
   – Nav Mode: TAB, Disp Mode: Ctrl + W

   Press the **Ctrl** + **W** keys simultaneously to initiate display mode, with the same information as that on the transmitter display.

3. Press **Esc** to cancel display mode.

   Press the **Tab** key. The the following screen is displayed:

   – [Next Menu=TAB][Next Item=ENTER]
   – [Edit = SPACE][Exit = ESC]
   – 1.0 Information

Further key operations access the menus as follows:
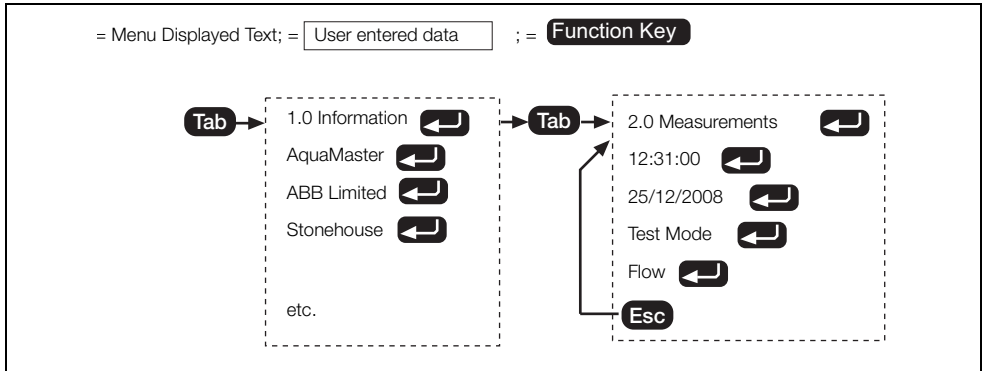
Note. Pressing ⏎ within a menu displays all the remaining parameters immediately.

3 Security Access

There are two levels of password control:

Level	Default Password	Menus
2	setup	1 to 7
4	am2k	1 to 13

Note. Passwords are case-sensitive and can be changed by the user in menu 4.0.

3.1 Logging In
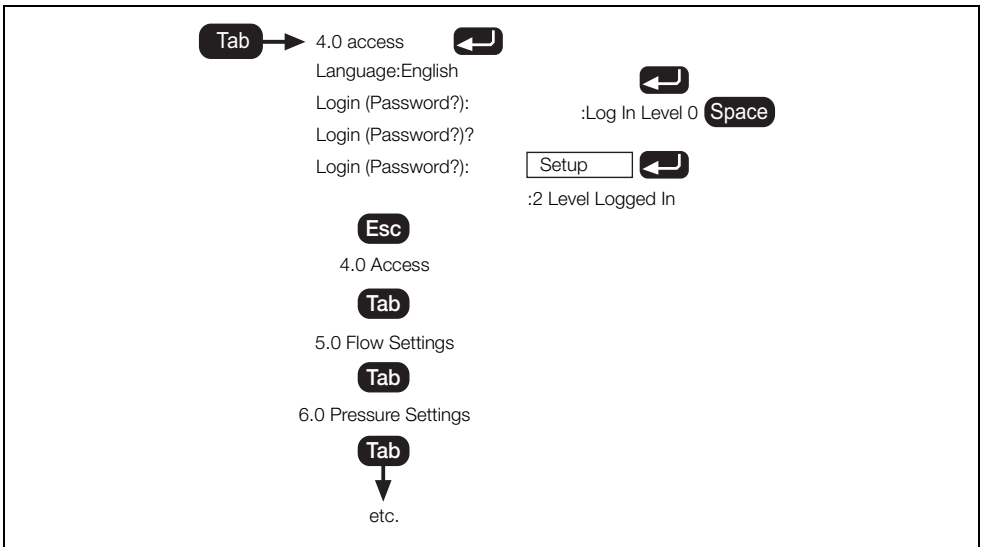
4 Parameter Changes

[Tab] ➔ Flow Units   : l/s   [Space]

             Flow Units?   l/s   [Space]   (Repeat 'Space' function key until required units are displayed)

             Flow Units?   l/m

             Flow Units   : l/m   [⏎]

             [⏎]
             FSD(100% or URV) 200 l/m

Note. Use [Esc] to escape or cancel in input mode (or to exit a menu).

4.1 Changing Selections

Note. Ensure that the correct access level is selected.

It is possible to enter data directly into the AquaMaster without navigating the menu system. This is achieved by using the 'Command Line Interface' (CLI). To read the value of a variable, type [>] followed by the variable number (see overleaf), then press [⏎].

To write a new value to a variable, type [>], the variable number, [=] and the new value required, followed by [⏎]. In both cases the AquaMaster replies with the new value of the variable (or a reason for failure) – for example:

Where:

| >217 | [⏎] | <0>217=42 |

| >217=42 | [⏎] | <3>217= Write Access Denied |

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', because writing to the flow rate is not allowed.

To change the flow FSD to 10 m3/min:

To cancel the password security, press **Esc** until the front screen is reached.

			Comment
>248= setup	⏎	<0>248=2 logged in	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)

4.2 Go To Menu

This procedure is only available on firmware v2.30 or above.

To quickly navigate the AquaMaster menu structure, assuming that the menu system has been activated (by pressing **Tab** 3 or 4 times) and that a suitable login level has been obtained, go to a given Menu by typing its number followed by Tab:

for example, to go to menu 12 type:

12 **Tab** and AquaMaster menu 12 is now accessible:

12.0 GSM Comms Settings

5 Menu Layout – All Versions

Key: R = Read Only

4 = Level & Security Access

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

	11.0 Logger		
405	Totalizer Logging hour	:	4*

*Present only in V2.40 and above.

	Check/Set Parameter	
33	Site Name**	:
151	7	:
164	1	:
165	1	:
253	Time	:
254	Date	:

319	Power Supply Type
	  0 Battery
	  1 Mains
	  2 Explorer
		:
		:
		:

290	0	:
334	0	:
335	0	:
371	1	:
401	0	:
406	1	:

**This must be a unique ID, (minimum 5 characters) and must not be left as '–'.

	12.0 GSM Comms Settings		
368	GSM Module Status	:	R
367	SIM Access Lock	:	4
357	SIM ID Number	:	R
355	SIM Password	:	4
366	Network	:	R
365	Signal Log (new –> old)	:	R
349	Total Connect Time	:	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	:	

	13.0 SMS Services		
362	Auto Report Phone No. 1 +447788898171 (Server No.)	:	4
382	Auto Report Phone No. 2 (User No.)	:	4
391	Auto Report Phone No. 3 (Defined Person for Alarms No.)	:	4
	Flow/Pressure Log	:	
395	Destination 1 +447788898171 (Server No.)	:	4
388	Flow Report Schedule	:	4
385	Flow Report Units	:	4
389	Pressure Report Schedule	:	4
386	Pressure Report Units	:	4
	Totalizer Auto-Reports	:	
400	Destination 1 +447788898171 (Server No.)	:	4
399	Totalizer Report Schedule	:	4
	Alarm Auto-Reports	:	
401	Destination 3 (Defined Person for Alarms No.)	:	4
402	Alarm Reports Enabled	:	4
	Exit	:	

*Log and Alarm reports cannot be sent unless the transmitter has been supplied from the factory with the SMS logging option enabled (parameter 406=1).

6 Wireless Communications

6.1 Access via GSM

6.1.1 Commissioning Test for Signal Strength

This test provides a means of carrying out 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, etc).

Menu 12 controls the GSM features.

Go to Menu 12 and select the 'Signal Test Wait Time' [>354]. Type the time in seconds that the system waits before starting the signal test. A countdown starts from the selected wait time to zero and this countdown 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.

6.1.2 SIM Numbers

Data-enabled SIMs sometimes have both a Voice Telephone Number and a Data Telephone Number. In these cases, use the Voice Number for Remote Access via SMS Text; use the Data Number for Remote Dial Up operation, for example, using LogMaster.

Note. If security of SIM does not need to be high, remove SIM protection as follows:

1. Install SIM in phone.
2. Enter PIN.
3. Remove PIN protection from SIM.

6.2 GSM WakeUp Control

6.2.1 Battery-Powered Meters

To conserve battery power, the GSM radio module is normally powered down. To operate remote communications (SMS Requests, Auto Report or Remote Dial Up), the GSM radio module can be woken either by going to menu 12 and requesting a Manual Wakeup [>358=1] (that forces the module to wake up for the WakeUp Duration [>352]) or by setting a programmable WakeUp Schedule as shown in Fig. 6.1. The WakeUp Schedule [>353] can be programmed for wake ups every 12 hours, 1 day 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 (if the schedule is set to 'Weekly').
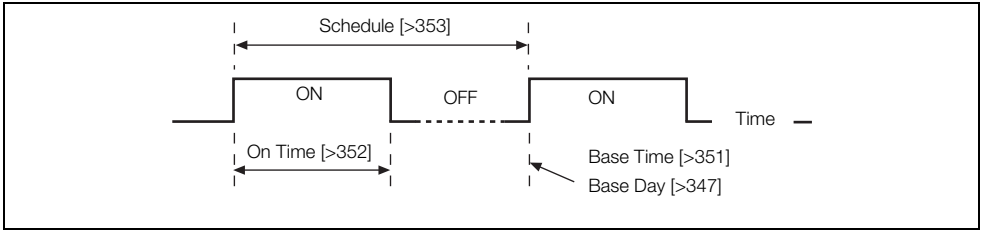

Fig. 6.1 Programming a Wakeup Schedule

6.2.2 Mains-powered Meters

When the meter is mains powered, the GSM radio module is powered continuously and is able to handle remote communications (SMS Requests, Auto Report or Remote Dial Up). If mains power is interrupted and the meter is powered from the backup battery, the GSM module does not operate.

> **Note.** On mains-powered GSM transmitters the module is rebooted automatically at midday every day. This process takes approximately 1 minute and it is therefore recommended that the Base Time is set to avoid the period around midday.

6.2.3 WakeUp Duration

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

- ■ Mains with battery backup

- ■ Battery only (dual internal cells)

- ■ External battery pack with backup

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

For battery-only transmitters, powered either by 2 internal cells or by an external battery pack, the WakeUp Duration (>352) has a range of 3 to 23 minutes.

6.3 GSM Antenna Installation

Before deciding on an antenna mounting location, check that the local signal strength for the chosen mobile phone network is satisfactory. Use the GSM-equipped transmitter's integral signal strength test facility to establish signal strength. Refer to 'Commissioning test for signal strength' in the Quick Reference Guide for the AquaMaster S with GSM (IM/AMG–QRG).

If a GSM-equipped transmitter is not available, a standard mobile phone on the same network, positioned as close as possible to the intended location, provides a good indication of local signal strength. For GSM and logger download services, a minimum of two visible signal strength indicator 'bars' are recommended. For SMS text, a minimum of one visible signal strength indicator 'bar' is recommended.

The following must also be observed when deciding on the antenna mounting location:

- For best results, mount the antenna as high above local ground level as possible.
- If the antenna must be mounted below ground, optimum results are achieved by ensuring:
    - there is a strong mobile phone network signal at ground level
    - the antenna is mounted 50 mm (2 in.) below the chamber cover (that must be plastic) – see Fig. 6.2
- Ensure the antenna does not become submerged under water – see Fig. 6.2.
- Metallic enclosures significantly degrade the signal. If an enclosure is used it must be non-metallic.
- Do not mount the antenna closer than 50 mm (2 in.) to any solid wall or surface – see Fig. 6.2.
- Do not mount the antenna beneath a solid surface (for example – metal cover, floor/ceiling etc.).
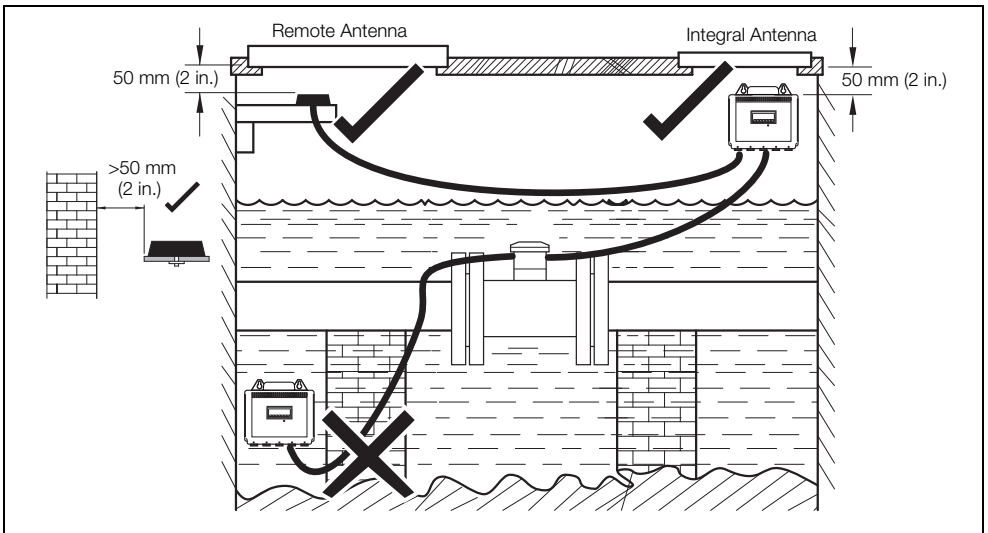
Fig. 6.2   GSM Antenna Installation

6.3.1 Connecting a Remote Antenna
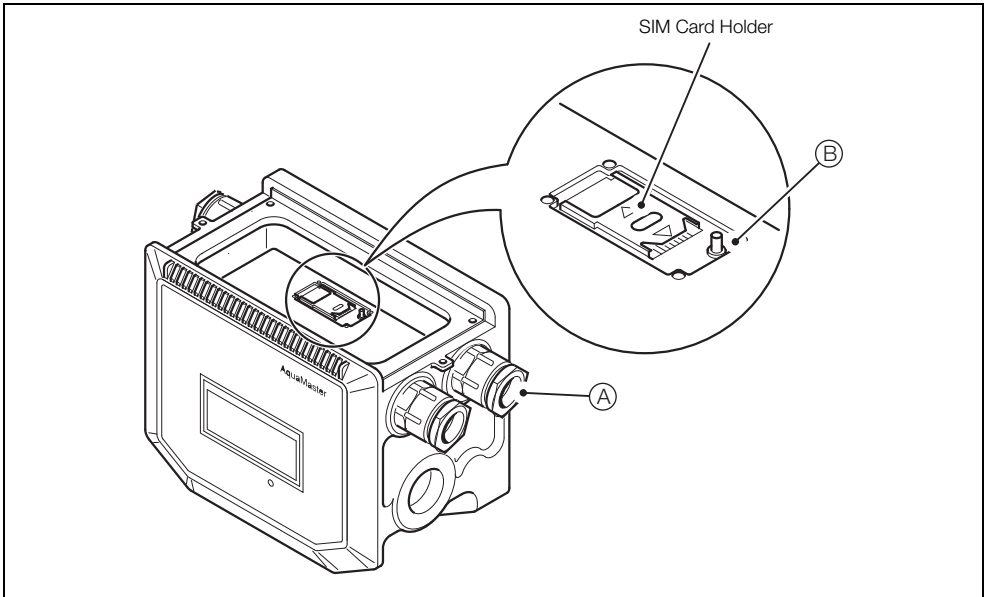
Fig. 6.3   Connecting a Remote Antenna – AquaMaster

To connect a remote antenna to an AquaMaster:

1. If the transmitter is not fixed in any way, arrange or hold it with the top cover uppermost.

2. Wash off any loose dirt from the case using plain water.

3. Remove the transmitter top cover and battery mounting tray – see IM/AM.

4. Pass the antenna cable through a spare cable gland (A).

5. Attach the antenna cable plug securely to the antenna connector (B).

6. Tighten the cable gland.

7. Refit the battery mounting tray and the transmitter top cover – see IM/AM.
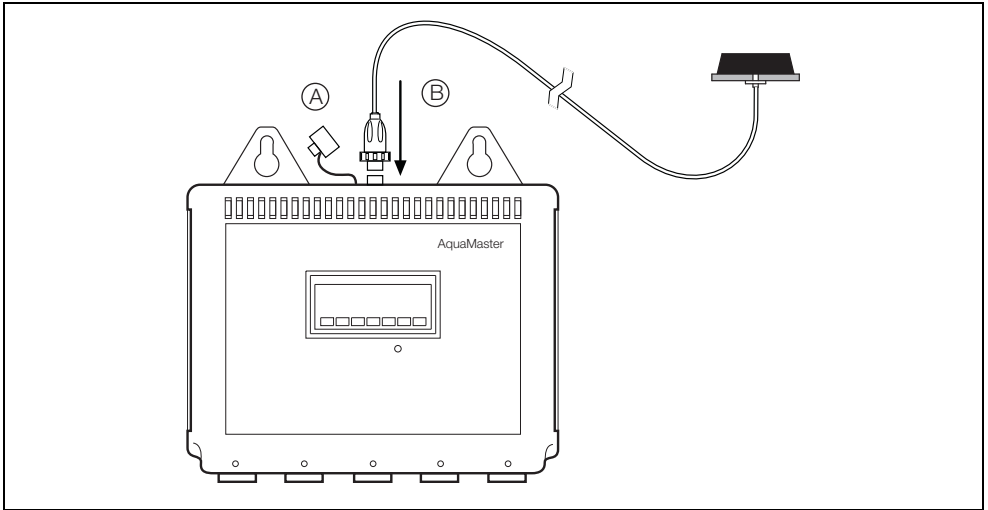
Fig. 6.4   Connecting a Remote Antenna – AquaMaster Explorer

To connect a remote antenna to an AquaMaster Explorer:

1. Remove the cover from the socket Ⓐ on top of the transmitter.

2. Gently push the antenna plug into the socket Ⓑ, then twist the screw ring clockwise until locked.

6.4 Status

6.4.1 GSM Module Status

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

0	=	Not Configured	7	=	Waiting Antitheft PUK
1	=	Off	8	=	Waiting PIN2
2	=	Off (SIM not fitted)	9	=	Waiting PUK2
3	=	Ready	10	=	SMS Mode
4	=	Waiting PIN	11	=	Command Handling
5	=	Waiting PUK	12	=	Connecting
6	=	Waiting Antitheft PIN	13	=	Connected

6.4.2 Signal Strength (current value)

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

for example, >348<0>=16

6.4.3 Signal Log (Signal Strength History)

A signal strength reading is taken each time the module is powered up (or daily for a mains-powered 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.

for example, 16 is the most recent reading in this example:

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

6.4.4 Total Connect Time

Accumulated connection (call) time can be obtained using the 'Total Connect Time' parameter in Menu 12 [>349]). This parameter is in hh:mm:ss format and excludes SMS text activity.

6.4.5 Access via SMS Text Message

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

6.4.6 SMS Request Message

SMS Request messages must have the following format:

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

where +password is the character '+' followed by the AquaMaster login password [>248] and the command can be either:

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

6.5 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 note that, where the AquaMaster is potted, the SIMs may not be able to be removed and security setup can then only be achieved via the AquaMaster.

SIM and PIN access via the AquaMaster 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.** Note. The PIN can only be changed via the local computer connection. It cannot be changed via GSM.

6.5.1 Access Lock

When the SIM Access Lock is enabled, the PIN is required to 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 then a number of retries are allowed (SIM dependent, but usually a further two attempts). If no correct PIN was received by the module in these attempts, 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).

6.5.2 PIN

The PIN is the password required to access the SIM if the Access Lock is enabled. If the AquaMaster 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 the AquaMaster 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. This is because it is not possible to have an empty variable string in the AquaMaster Menu]

When viewed, the SIM Password displays the actual PIN string for login levels 4 and above. For login levels 3 and below it is displayed as a number of asterisks (*) – one asterisk for each digit of the PIN.

6.5.3 Setting AquaMaster to Use SIM's existing PIN

To allow AquaMaster to use the SIM's existing PIN, change the SIM password to be the PIN of the SIM card. AquaMaster 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.

6.5.4 Using AquaMaster to change SIM's PIN

To change the 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'.

6.5.5 Using AquaMaster to Change a SIM's Access Lock Status

This requires that the PIN has already been configured.

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

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

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 remote port.
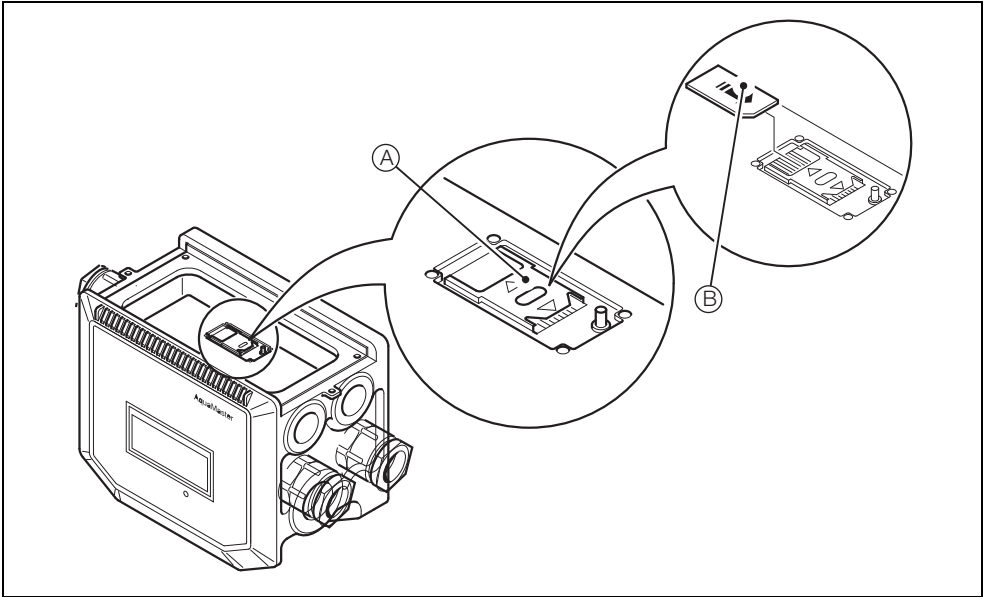

6.6 Installing a SIM Card

Fig. 6.5   Installing a SIM Card – AquaMaster

To install a SIM card into an AquaMaster:

1. If the transmitter is not fixed in any way, arrange or hold it with the top cover uppermost.
2. Wash off any loose dirt from the case using plain water.
3. Remove the transmitter top cover and battery mounting tray – see IM/AM.
4. Slide to unlock and open the SIM card holder cover (A).
5. Insert the SIM card (B) contact side down and bevelled edge first, into the SIM card holder.
6. Close the SIM card holder cover and slide into locked position.
7. Refit the battery mounting tray and the transmitter top cover – see IM/AM.
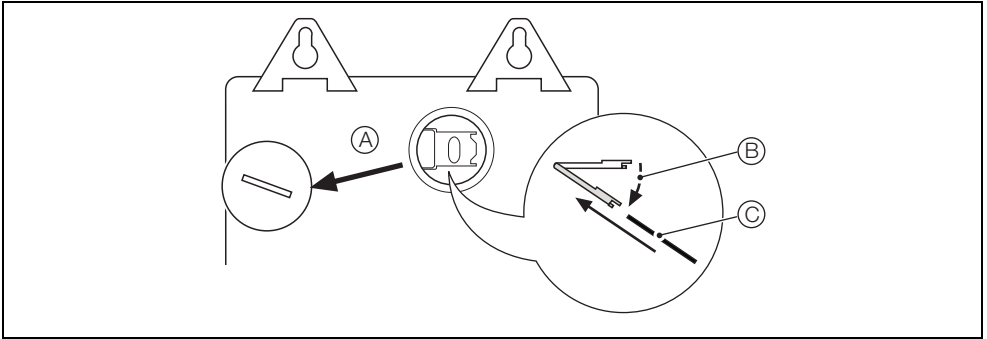
Fig. 6.6   Installing a SIM Card – AquaMaster Explorer

To install a SIM card into an AquaMaster Explorer:

1.   Remove the transmitter from its mounting point.

2.   Use water to wash off any loose dirt from the case.

3.   On the back of the transmitter, unscrew and remove the cover Ⓐ to the SIM card holder.

4.   Carefully lift the right-hand edge of the holder outwards Ⓑ.

5.   Slide the SIM card into the carrier, contact side down and bevelled edge to the top-right Ⓒ.

6.   Close the holder until it clicks into place and refit the cover.

6.7 Auto Reports

This feature sends information via SMS text messages from an AquaMaster 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.

6.7.1 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 the ABB AutoChart numbers are: +447788898171 or 00447788898171) or the area code and number (07788898171) 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.

6.7.2 Text Auto-Reports

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

for example, >363=TON;TFA.

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

6.7.3 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 only functional for mains-powered transmitters; while on battery power, these options are disabled

6.7.4 Flow and Pressure Log Auto-Reports

> **Note.** Log and Totalizer reports cannot be sent unless the transmitter has been supplied from the factory with the SMS logging option enabled (parameter 406=1).

SMS messages containing Flow and/or Pressure data from Logger 1 for the previous 24 hours can be sent automatically by the AquaMaster 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.

6.7.5 Flow and Pressure Report Schedules

> **Note.** Log and Totalizer reports cannot be sent unless the transmitter has been supplied from the factory with the SMS logging option enabled (parameter 406=1).

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)

6.7.6 Totalizer Auto-Reports

> **Note.** Log and Totalizer reports cannot be sent unless the transmitter has been supplied from the factory with the SMS logging option enabled (parameter 406=1).

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

6.7.7 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)

6.7.8 Alarm Auto-Reports
This controls the sending of a report if one or more of these events occur:

sensor error

coil error

power supply error to the coil drive

battery alarm

If Alarm Reporting (>402) has been enabled, an immediate alarm report is generated on any of the above errors and sent via GSM to the phone number referred to in Destination (>401) if:

no Alarm Report has been sent out during the last 24 hours (no alarm flag present)

and

more than 24 hours have 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.

PRODUCTS & CUSTOMER SUPPORT

Products

Automation Systems
- for the following industries:
    - Chemical & Pharmaceutical
    - Food & Beverage
    - Manufacturing
    - Metals and Minerals
    - Oil, Gas & Petrochemical
    - Pulp and Paper

Drives and Motors
- AC and DC Drives, AC and DC Machines, AC Motors to 1kV
- Drive Systems
- Force Measurement
- Servo Drives

Controllers & Recorders
- Single and Multi-loop Controllers
- Circular Chart and Strip Chart Recorders
- Paperless Recorders
- Process Indicators

Flexible Automation
- Industrial Robots and Robot Systems

Flow Measurement
- Electromagnetic Flowmeters
- Mass Flowmeters
- Turbine Flowmeters
- Wedge Flow Elements

Marine Systems & Turbochargers
- Electrical Systems
- Marine Equipment
- Offshore Retrofit and Refurbishment

Process Analytics
- Process Gas Analysis
- Systems Integration

Transmitters
- Pressure
- Temperature
- Level
- Interface Modules

Valves, Actuators and Positioners
- Control Valves
- Actuators
- Positioners

Water, Gas & Industrial Analytics
Instrumentation
- pH, Conductivity and Dissolved Oxygen Transmitters and Sensors
- Ammonia, Nitrate, Phosphate, Silica, Sodium, Chloride, Fluoride, Dissolved Oxygen and Hydrazine Analyzers
- Zirconia Oxygen Analyzers, Katharometers, Hydrogen Purity and Purge-gas Monitors, Thermal Conductivity

Customer Support

We provide a comprehensive after sales service via a Worldwide Service Organization. Contact one of the following offices for details on your nearest Service and Repair Centre.

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