

AROW Series

Data Diode

INSTALLATION AND OPERATION

Applicable Products

[AROW](#) Data Diode All Models

Part Number: AROW-0610,
 AROW-0510
 AROW-0520

Document Reference

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Somerdata Ltd.
Underwood Business Park
Wells
BA5 1AF
UK

Sales & Customer Support

Phone: +44 (0)1179 634050

E-Mail: sales@somerdata.com
 support@somerdata.com

Website: www.somerdata.com

AROW Series *Data Diode*



Revision History

| Issue | Date | Notes |
|-------|-------------|--|
| 6 | August 2017 | Change of contact details, troubleshooting additions |
| 5 | May 2015 | Front panel indicators clarification, V1R7 firmware additions, buffer overrun TCP reset |
| 4 | Nov 2014 | UDP, Multicast information added, typo corrections V1R6 firmware onwards |
| 3 | Jul 2013 | Gateway address information added, socat UDP example added |
| 2 | 10 Jan 2013 | Added LED functionality from firmware V1R3 Removed 4 byte transfer limitation Added redundancy functionality, characterisation and mechanism description |
| 1 | 15 Aug 2012 | Initial Issue |

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1. INTRODUCTION

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What's in this User Guide

This User Guide covers SomerData's **AROW** Advance Reliable Optical Wormhole Data Diode.

*Section 2 – **PRODUCT DESCRIPTION*** gives an overview of your unit's capabilities and features.

*Section 3 – **INSTALLATION*** describes the process of physically installing AROW.

*Section 4 – **CONFIGURATION*** describes the process of configuring AROW for operation

*Section 5 – **OPERATION*** describes how to use AROW.

*Section 6 – **CONNECTORS AND INDICATORS*** describes connection, switch and indicator functions.

*Section 7 – **CONTROL AND STATUS*** describes the available software controls and status registers.

*Section 8 – **FIRMWARE UPDATE*** describes the Process of updating the firmware that runs AROW.

*Section 9 – **SPECIFICATIONS*** describes AROW's .

*Section 10 – **SUPPORT*** describes the procedure and contact details for obtaining customer support on this product.

*Section 11 – **WARRANTY*** your rights and obligations in support of this product.

*Section 12 – **NOTICES*** statutory documentation and certificates.

*Section 13 – **INDEX***

User Guide Availability

Printed copies of Hardware and Software User Guides are supplied with the original products on request.

Additional printed copies, including the Programmer's Reference Guide can be supplied on request. Please contact your local supplier or SomerData for ordering details.

Electronic copies (Adobe Acrobat files) are included on the SomerData electronic delivery medium that is supplied with the original products.

The User Guide library, which also includes product data sheets, can be accessed by browsing the *\Documents* folder for the required document.

Additional and updated copies are available through our website. or can be supplied on request. Please contact your local supplier or SomerData for ordering details.

2. PRODUCT DESCRIPTION

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Introduction

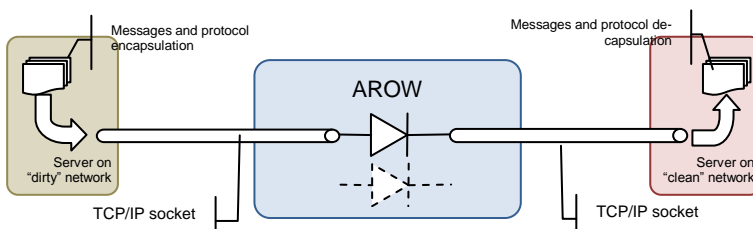
AROW is a 1U rack mountable high availability, IPv4 based Gigabit Ethernet uni-directional network access device (Data Diode). TCP, UDP and Multicast protocols are supported natively.

Internal simplex optical links between the unsafe network (dirty) and the secure and restricted network (clean) ensure a reliable data link in one direction and guarantees no reverse data path.

AROW may be supplied in any of 3 basic configurations – single channel, dual channel or high-availability redundant single-channel.

Plug-in data interfacing allows connections to RJ-45 Copper Gigabit Ethernet and/or Optical Fibre Gigabit Ethernet.

Block diagram



3. INSTALLATION

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Preparation

These instructions should be followed before installation, and any time the unit is moved, connections changed or re-installed.

Check the items received to ensure that they match your data input/output configuration requirements.

No special tools are required. You will need a large flat headed screwdriver.

In common with other electroonic equipment of this class, [AROW](#) needs to be installed in a controlled environment where the temperature will not go above 40°C or below 0°C, and where the relative humidity is between 15% and 55%, and is non-condensing.

Ensure that you allow the unit to stabilise in this environment before use, especially if it has been subjected to transportation in low-temperature or high-humidity environments

Check that the cables that you will be using to connect to the data inputs and the control and data Ethernet ports are of correct length and are well and correctly labelled. The cables should be tied into a wiring loom for tidiness. Electrical Data cables should be a minimum of Cat 5e for GBE operation, optical cables should be laser compatible (yellow sheath), 9/125 terminated for LC connection.

Remove the unit from all packaging. Locate the accessories pack, Gigabit Ethernet SFP (Small Form-factor Pluggable) modules and the power supply cable.

Physical Installation

The unit is designed to fit in a 19" rack enclosure with M6 (supplied), 10-32UNF or 12-24UNC fasteners to attach the unit to the rack. Note that the unit is NOT self-supporting and may require additional bracing or tray support in some vibration environments. It should be removed from the rack for transportation.

Using the screws and washers supplied in the accessories bag and a large flat head screwdriver, screw the unit into your rack.

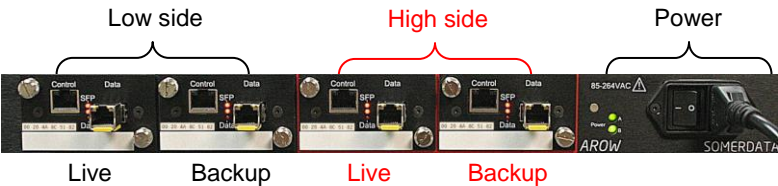
Connections

Fit SFP modules

The Gigabit Ethernet SFP modules have been packaged separately for transport. Push each SFP modules into the SFP cages, until it clicks into place.



Record MAC addresses



Control MAC addresses should be supplied with your unit and are printed on each module control port. These should be recorded as they will be needed for configuration.

| | Control port MAC address |
|-------------|--------------------------|
| Low live | 00:20:4A: |
| Low backup | 00:20:4A: |
| High Live | 00:20:4A: |
| High backup | 00:20:4A: |

Network connections

Connect low side Control and Data network ports to the dirty network(s) and High side network ports to the clean network(s) prior to power connection.

Connect power

Connect power and turn switch to on position. Please note: while it is usually safe to connect data and control connections with the unit power applied, precautions should be taken when connections have come from a different electrical environment or over long cable runs, where common-mode voltage differences or electro-static potentials may arise. Ensure that all rack ground connections are secure before powering on the unit and connecting data cables. Power-cycling may be required to re-initialise non-High-Availability types of unit.

Network requirements

High side data connections must be on low-contention Gigabit Ethernet networks. Any network delays on the high side network will cause AROW's buffers to fill. If delays on the high side network are greater than on the low side, the buffers will overrun, causing loss of data.

Buffer state (and thus network performance) can be monitored by reading status (see section 8 CONTROL AND STATUS)

Redundant Configuration

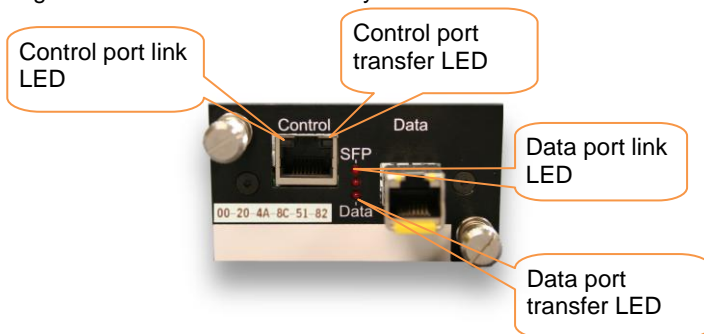
If supplied in fully-redundant mode, the Backup Control and Data connections should be connected to a suitable backup switch/router. While configuration of a fully-redundant network is beyond the scope of this document, a standard configuration will involve two servers with independent communication between them, suitable for either automatic backup or manual intervention for maintenance etc. AROW's unique ability to switch network addresses on network failure means that no further reconfiguration is required when switching between main and back-up servers.

Data ports must be connected to 1000base-T ports. Before plugging in a network cable, the LED labelled "SFP" will flash (If it is off, this indicated that no SFP module is detected).

When a Gigabit Ethernet link has been established, this LED will remain constantly on.

Control Network Connections

Once setup, AROW does not need any further configuration, however for remote monitoring purposes, each module has it's own independent network port. These should normally NOT be connected to the data network, and since they control the data network port addressing should not be used in an insecure environment where an attacker may be able to gain control of the unit and deny access.



Control port should be connected to a 10/100Base-T network only. When a good connection is made, the left LED on the control port RJ45 socket will turn green to indicate the link is up. The right LED will flash with Ethernet traffic.

4. CONFIGURATION

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Introduction

To integrate AROW into a network, the IP address for each Control and each Data port must be set. AROW will have been factory-set with network addresses before delivery

Setting the control port IP address

The control port IP address can only be set from a machine on the same sub network. You will need the MAC address for each control port to be set. This is printed on each module panel.

Open a Windows command prompt (Start, Run, enter command or CMD depending on your operating system). For linux, open a command line terminal.

From the command prompt enter the new ARP (Address Resolution Protocol) entry for the IP address you want to set as shown below: This will associate a network address with a MAC address.

ARP -S 192.168.xxx.xxx 00-20-4A-xx-xx-xx
(for linux: arp -s 192.168.xxx.xxx 00:20:4A:xx:xx:xx)

Hit return

Open a new command prompt.

Type `ping -t 192.168.xxx.xxx`
(linux: `ping 192.168.xxx.xxx`)

The “pings” will fail to start with but will give an indication of progress.

Back to the first command prompt telnet to the same IP address **using port 1**.

e.g. Telnet 192.168.xxx.xxx 1

Hit return. (message ‘failed to connect’ should appear within 2 to 3 seconds)
The “Pings” should start to work.

At the next command prompt telnet to the same IP address **using port 9999**.

Telnet 192.168.xxx.xxx **9999**

Hit return. You will be prompted to "Press Enter to go into Setup Mode"

Hit return again as soon as you see the prompt to access the configuration choices. The prompt will time out after ~ 3 seconds.

Select 0 for server configuration.

Manually enter the IP Address. This permanently assigns the IP address,

Manually enter the gateway address (optional)

Manually enter the host bits for the subnet mask

Select 9 to save and exit

Repeat these steps for each module's control port.

Setting the data port IP address

Linux:

You will need Python 2.7 installed on your Linux box. For each **Live** Data port, set the IP address using the "control_arow.py" python script supplied on the delivery medium:

```
./control_arow.py -H 192.168.xxx.xxx -i 192.168.yyy.yyy
```

-H 192.168.xxx.xxx defines the control port that will be used to set the data port IP address and -i 192.168.yyy.yyy defines the data port IP address.

Windows:

Use the WinAROW program supplied on the delivery medium. This graphical program allows for configuration and dynamic status display of the module .

If AROW is in fully-redundant configuration, a backup module's data port will automatically receive its settings from the live module

AROW is now ready to be used.

5. OPERATION

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Introduction

Both high side (clean) and low side (dirty) AROW TCP socket servers listen to connections on port 9876. UDP data can use any normally permitted port, Multi-cast data is supported for any address in the normal multi-cast range.

Redundant Version

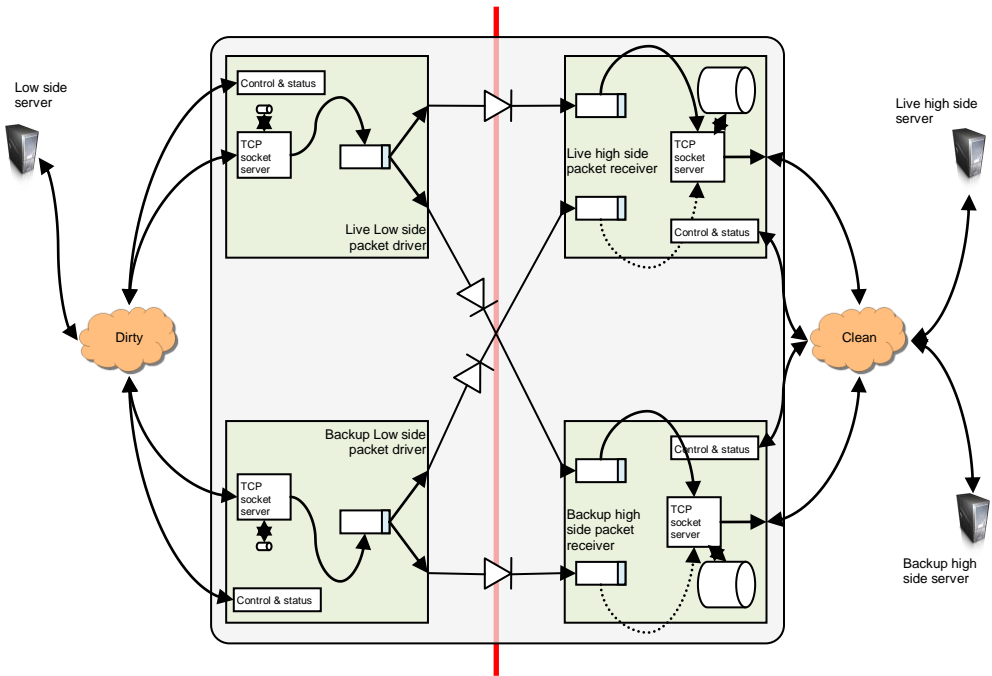
For firmware version 1 revision 3 and later, a dual redundant backup path is provided with automatic failover mechanisms.

All versions

Any data received on the low side socket is transferred over the internal optical link to the high side.

Any data received from the optical link is sent on the high side socket.

There is no reverse data path. Data received on the high side socket will be silently discarded. As the low side optical connections are not made, no data will ever be sent from **AROW** out through a low side TCP socket.



Low Side

Any data received by the socket on the low side host is transmitted over fibre optic to the high side.

TCP example (assuming low side ip address is 10.0.0.9):

```
low side host:~$ nc -vvn some_file.raw 10.0.0.9 9876
```

or for streaming data:

```
low side host:~$ dd if=/dev/zero bs=65536 |pv| nc -vvn 10.0.0.9 9876
```

or for streaming checkable data:

```
low side host:~$ generator -p dword -f eti |pv| nc -vvn 10.0.0.9 9876
```

or for webcam streaming:

```
low side host:~$ avconv -f video4linux2 -s 640x480 -r 25 -i /dev/video0 -f mpegts -q 2 tcp://10.0.0.9:9876
```

High Side

The data received over fibre optics on the high side is sent over the TCP socket connection made by the high side host.

for example (assuming high side data port ip address is 10.0.1.12):

```
high side host:~$ nc -vn 10.0.1.129876 > received_data.dump
```

Comparing the md5sum of set and received files can confirm sent and received are the same.

or for streaming data:

```
high side host:~$ nc -vn 10.0.1.129876 | pv > /dev/null
```

or for streaming checkable data:

```
high side host:~$ nc -vn 10.0.1.129876 | STMChecker -p dword  
-f eti
```

or for webcam streaming:

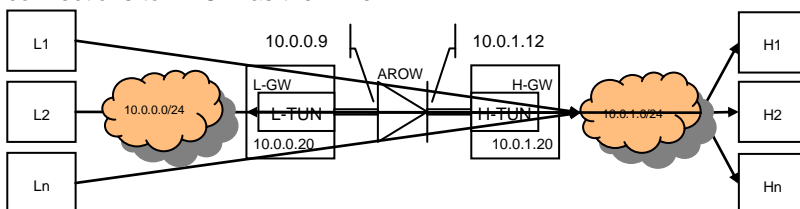
```
high side host:~$ nc -vn 10.0.1.12 9876 | mplayer -
```

or

```
high side host:~$ nc -vn 10.0.1.12 9876 | avplay -
```

UDP over SOCAT

Multiple parallel UDP streams of data can be sent through AROW using socat to create virtual network interface ports using tcp socket connections to AROW as the "wire"



Socat is a Linux open source application that includes tunnelling a network interface over a TCP socket connection.

Socat can be found here: <http://www.dest-unreach.org/socat>

Assuming the low side gateway (L-GW) host has a connection to the 10.0.0.0/24 network, create the low side of the tunnel (L-TUN):

```
# socat -d -d TCP:10.0.0.9:9876 TUN:192.168.254.1/24,up
```

Assuming the high side gateway (H-GW) host has a connection to the 10.0.1.0/24 network, create the high side of the tunnel (H-TUN):

```
# socat -d -d TCP:10.0.1.12:9876 TUN:192.168.254.2/24,up
```

(Note, -d -d is optional and is useful for confirming a network connection to AROW.)

Now we should have a "tun" interface entry in "ip addr" or "ifconfig" of each of the hosts.

On the low side gateway machine (L-GW) add a line to the routing table that send packets for the 10.0.1.0/24 network over the tunnel:

```
# route add -net 10.0.1.0/24 gw 192.168.254.1
```

On each of the low side host machines (L1, L2... Ln), add a line to the routing table to send any packets for the 10.0.1.0/24 network to L-GW

```
# route add -net 10.0.1.0/24 gw 10.0.0.20
```

Sending UDP over that tunnel is simple. For instance:

On a high side host (for example H1 having the ip address 10.0.1.5):

```
$ netcat -u -s 10.0.1.5 -p 50002 10.0.0.5 50001
```

And on a low side host (for example L1 having the ip address 10.0.0.5):

```
$ netcat -u -s 10.0.0.5 -p 50001 10.0.1.5 50002
```

Now any packets sent from the low side netcat instance will be received by the netcat instance on the high side. Packets sent from the high side will be silently dropped.

UDP/Multicast Data

UDP data requires some attention to routing. Since the destination network cannot be resolved from the source network, the routing table from the source must explicitly declare a route and an appropriate gateway.

Taking the addresses from the TCP example above, first add a gateway route on the low-side to the high-side:

Linux: (with root privileges)

```
sudo route add -net 10.0.1.0/24 via 10.0.0.9
```

This tells the router to send all packets destined for network 10.0.1.x through the gateway 10.0.0.9 (the low-side diode port).

The high-side route also needs to be established so that ARP requests can be resolved correctly.

```
sudo route add -net 10.0.0.0/24 [dev eth0]
```

The optional dev eth0 specifies a particular network device, if the router is a configured pc platform for example.

To test this, use netcat as the SOCAT example above, or install a streaming media player like VLC and send test data across the diode.

A webcam can be used as a source of streaming data:

Linux UDP Example:

assuming the webcam is /dev/video0 a vlc command line entry on the sending pc might be

```
vlc -vv v4l2:///dev/video0 --sout "transcode{vcodec=h264,acodec=mp3} : rtp{dst=10.0.1.50,port=5004,mux=ts,ttl=1}" --sout --keep
```

In this example, the destination device is at 10.0.1.50 (this will be where another vlc instance will run) using port 5004. It is necessary to transcode the basic udp stream and send it using an mpeg transport stream to cope with the unreliable performance associated with udp transfers. VLC is also running in very verbose mode in this example.

On the receiving platform another instance of VLC is started using the much simpler command line

```
vlc rtp://@:5004,
```

Multicast is very similar but with a multicast address substituted- sender

```
vlc -vv v4l2:///dev/video0 --sout "transcode{vcodec=h264,acodec=mp3} : rtp{dst=239.255.12.42,port=5004,mux=ts,ttl=3}" --sout --keep
```

Note that the TTL level for multi-cast is important, since this will limit the number of routers the multi-cast packets will traverse.

receiver

```
vlc rtp://@239.255.12.42:5004 --miface=eth2
```

Here there is also the optional addition of explicitly defining the multicast interface to a specific network interface card.

File transfer software

For non-streaming transfers, it is expected that AROW data transfers would be controlled with software or scripted transfers.

Python scripted File Transfer and filtering software is available on the supplied delivery medium (AROWBFTP). Instructions on its use are available from within the tar ball . See Document AROW-MAN-602 for details.

Performance Characterisation

Throughput

113MBytes/second aggregate sustained throughput can be achieved using netcat. Receiving applications need to be able to sustain this throughput to keep the socket from blocking.

Buffer overruns (TCP Data)

A blocked TCP socket will hold data up in the high side data buffer. If the socket is blocked for too long with data still arriving from the low side, data will start to overflow the buffer and be lost.

At maximum throughput, with no new data being put into the buffer from the low side, it will take just over 2 seconds to read all the data from the buffer, so there is a 2 second latency between a buffer overrun error occurring and the errored data appearing at the application.

Application software needs to accept data as fast as possible. A decoupling buffer/queue should be implemented so that data is accepted even when processing is (temporarily) slower than the received data rate.

If there is any chance the high side application cannot sustain the socket throughput, low side data should be throttled back to enable the high side to recover from situations where the application can't sustain the throughput.

If the buffer overruns on the high (receiving) side, the TCP socket will be reset, all remaining data in the buffer will be lost.

UDP data is not affected by TCP socket blocking

6. CONNECTORS AND INDICATORS

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Introduction

AROW is built as a modular system that can be factory-configured as live and backup module, 2 independent or 1 independent diode for the low (connected to "dirty" network) and high (connected to "clean" network) sides of the device.

Boards connected to the low network are placed in the black slots, boards connected to the high network are placed in the red slots.

Data can only travel internally from black slots to red slots.

Each board has a Data and a Control & Status ethernet network connection.

The Gigabit Ethernet Data connection is via an SFP socket which is normally populated with a Copper RJ45 physical connected, but can be replaced with fiber optic Gigabit Ethernet modules if required. N.B. Data ports do not support 10/100 connections.

AROW Series *Data Diode*

The Control and Status 10/100 RJ45 Ethernet port is used for setup and monitoring.

AROW is available in 3 configurations, a single diode, a dual diode and a single redundant diode.

In a single diode configuration there will only be one module in the red slots and one module in the black slots. The spare positions will be blank.

In the dual diode and redundant diode configurations, there will be modules in all slots.

Please note that for the purposes of identification, the single diode configuration will use the 'Live' indicators and designations, the dual diode will use the Live and Backup indicators and designations, 'Live' being Diode 1 and 'Backup' being Diode 2. Note also that in the Dual Diode configuration the two diodes are entirely independent, sharing only the power supply.

Network Interface Module Slots

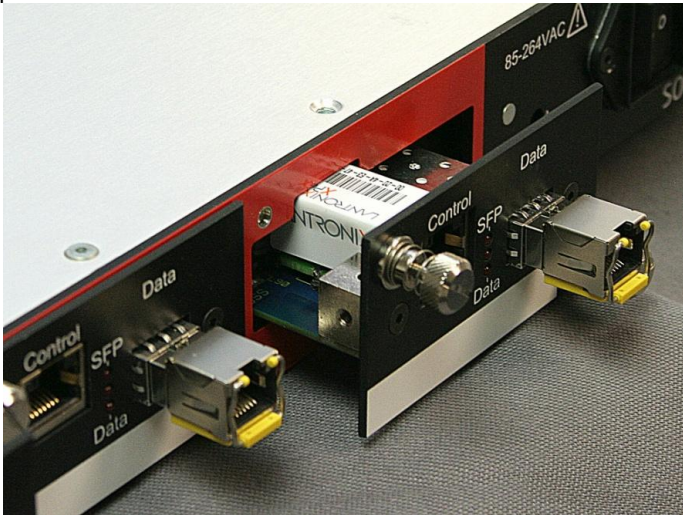
Rear Panel picture (shown with Backup Modules removed)



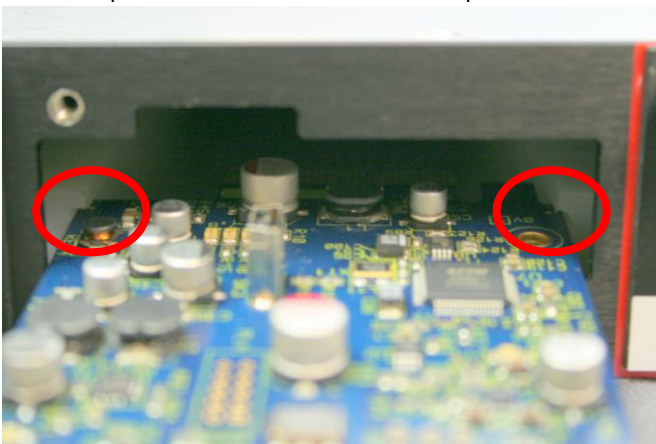
The network interface modules are hot swappable.

AROW Series *Data Diode*

If a failure occurs or an upgrade required, undo the captive screws and pull the card out.



To insert a board, line it up with the internal guide rails and push it in until the board panel is flush with the unit's back panel.

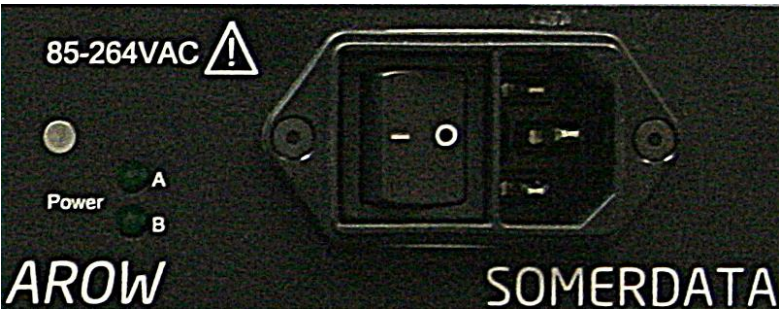


The board will click into place as the connector mates. Finally, secure the 2 captive screws.

Connectors

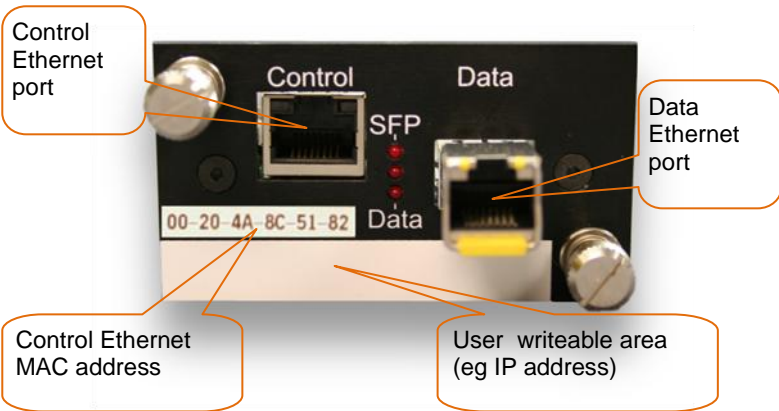
AC Power inlet

The combined AC power switch and inlet uses a standard 3-pin IEC connector



Control Ethernet connector

The Ethernet interface uses a standard RJ-45 8-way connector.



Data Ethernet

When a copper Ethernet SFP module is fitted, the Data Ethernet Interface uses a standard RJ-45 8-way connector.

When an optical Ethernet SFP module is fitted, the Data Ethernet interface uses LC optical connector types.

Rear panel Indicators

Power indicators



Fully-redundant systems

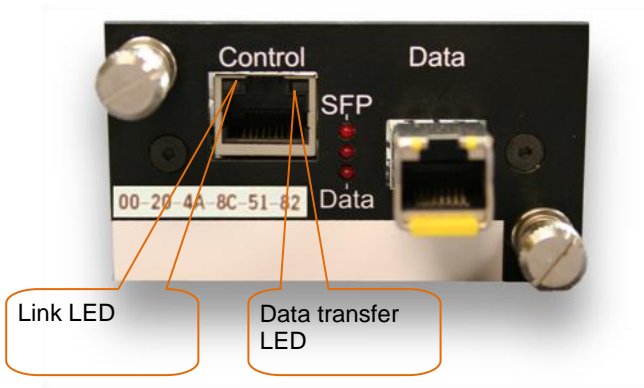
A and B power supply unit status LEDs will indicate power failure if they are off.

If either one is off but the other is on, the power supply should be replaced at the next scheduled maintenance time.

Dual and Single Systems






Only the A power supply LED will be lit to indicate normal operation.

Control Ethernet connector

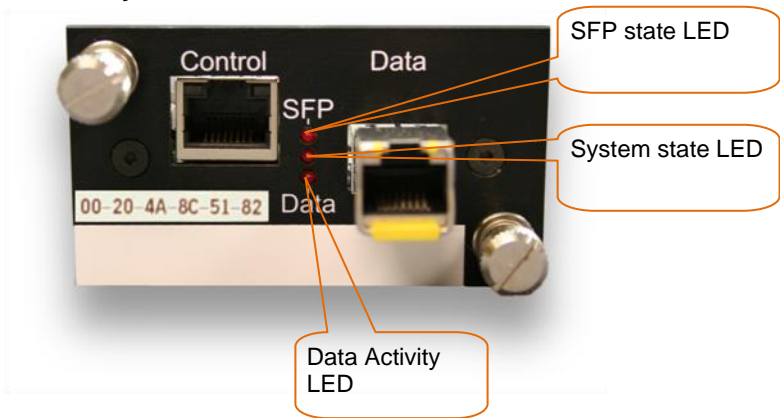


The Link LED indicates the status of the control and status Ethernet connection:






Table 6-1

| <i>LED</i> | <i>LED Colour</i> | <i>Meaning</i> |
|-------------------|---|---------------------------------|
| Link LED | Not lit  | No link established |
| | Solid Amber  | 10Mbit/Second link established |
| | Solid Green  | 100Mbit/second link established |
| Data transfer LED | Green flash  | Full duplex Data transfer |
| | Amber flash  | Half duplex data transfer |

Data and system indicators

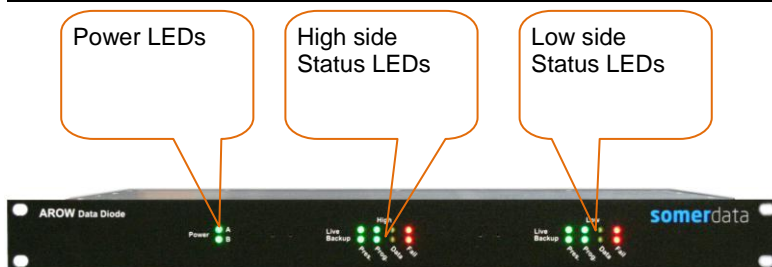


| | SFP module absent | SFP module present | Ethernet link up |
|---------------|----------------------|-----------------------|------------------|
| SFP state | | Flash | |
| System OK | | | |
| Data Activity | | | Flash |

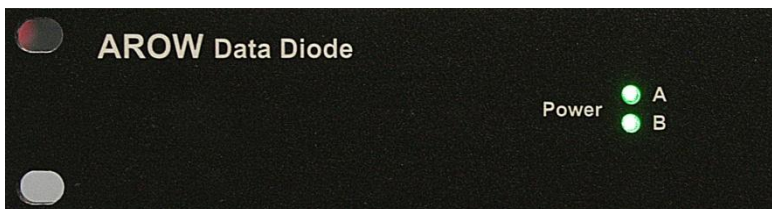
| Data Activity | Not lit |  | TCP socket not connected |
|------------------|--------------------------------|---|---|
| | Solid Green |  | TCP socket connected, data channel idle |
| | Normally green, short flash |  | Ethernet Data transfer while socket is open |
| | Normally off, short flash |  | Ethernet data transfer while socket is closed |
| | Long, steady flash |  | Module is in standby mode, ready to take over from live module |

Note 1: the Colour of the LED may change.

Front Panel Indicators



Power LEDs



Redundant Systems

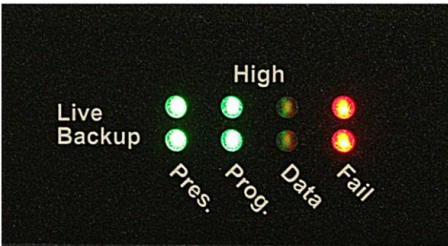
A and B power supply unit status LEDs will indicate power failure if they are off.

If either one is off but the other is on, the power supply should be replaced at the next scheduled maintenance time.














Non-redundant systems (Single and Dual Diodes)

A power supply unit status LED will indicate power failure if it is off.

Status LEDs – Redundant Systems



valid from firmware version 1 Rev 3













| LED | LED Colour | Meaning |
|----------------|---|--|
| Board present | Not lit  | Gigabit Ethernet Board missing |
| | Solid Green  | Gigabit Ethernet Board present |
| Prog good | Not lit  | Gigabit Ethernet Board program not loaded |
| | Solid Green  | Gigabit Ethernet Board ready |
| Data Activity | Not lit  | TCP socket not connected |
| | Solid Green  | TCP socket connected, data channel idle |
| | Green flash  | TCP socket connected, active data transfer |
| | Amber flash  | Data loss because of full buffer |
| Failure alarms | Not lit  | Undefined failure or power off |
| | Solid Green  | All ok - no problems to report |
| | Solid Red  | Gigabit Ethernet link is down |
| | Amber flash  | Loss of redundancy |
| | Red flash  | Both internal Optical links are down |

Status LEDs – Single and Dual Diode Systems

For the purposes of identification, in Dual Diode configurations, Diode 1 is 'Live', Diode 2 is 'Backup'

For single diode systems, all Backup indicators will be non-illuminated.

valid from firmware version 1 Rev 3

| LED | LED Colour | Meaning |
|----------------|---|--|
| Board present | Not lit  | Gigabit Ethernet Board missing |
| | Solid Green  | Gigabit Ethernet Board present |
| Prog good | Not lit  | Gigabit Ethernet Board program not loaded |
| | Solid Green  | Gigabit Ethernet Board ready |
| Data Activity | Not lit  | TCP socket not connected |
| | Solid Green  | TCP socket connected, data channel idle |
| | Green flash  | TCP socket connected, active data transfer |
| | Amber flash  | Data loss because of full buffer* |
| Failure alarms | Not lit  | Undefined failure or power off |
| | Solid Green  | All ok - no problems to report |
| | Solid Red  | Gigabit Ethernet link is down |
| | Red flash  | Internal Optical link failed |

* AROW-S only

Connecting and Disconnecting – Single and Dual Diodes

The redundant diode version contains special circuitry designed to take care of loss of connectivity during data operations.

The Single and Dual version do not have this capability, since there is no alternative path. In general therefore we do not recommend connecting and disconnecting the Ethernet cable while data is being transferred.

The Diode contains a significant data buffer, capable of storing up to 2 seconds worth of data at full transfer rates. If the high side is summarily disconnected, but the low side continues to receive data, this buffer will fill, and data transfer will stop. On reconnection of the High side, the stored data will be transferred before any new data is received, meaning that the received data will be discontinuous, containing a buffer's worth of data. This can cause significant problems to downstream data processing equipment, depending on the type of data being transferred. Also, this will increase the latency of data across the diode, which will be permanent until the sending side is reset.

For these reasons, the correct sequence of software processing to achieve the lowest latency and no corrupted data

Connecting

1. Start the High (receive) side processing software and establish the socket connection.
2. Start the Low (send) side software .

Disconnecting

3. Stop the Low(send) side software and disconnect the network.
4. Stop the receive side software and disconnect the network.

Recovering a socket connection after unscheduled disconnect.

The abrupt disconnection of the Ethernet connection while powered can cause the Data socket to stop responding. This can be recovered by using the control port of the module to send reset commands.

First, stop any running software that is accessing the locked socket.

If you are using WinAROW to monitor the receive module, this is simply accomplished by clicking the TCP rst reset button on the main screen, then the Connect button on the setup screen.

If you have implemented your own control program, you should add the ability to reset the TCP socket, and combine it with setting of the Data socket IP address, Mask and Gateway Address.

7. REDUNDANCY FEATURES (AROW-0610 only)

In this Section

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Introduction

[AROW-0610](#) is an optical data diode with fully redundant data paths. This section will describe the conditions in which a backup module will take over from a live module, how and how fast this handover occurs and what action need to be taken to bring the system back to full redundancy. This section does not apply to types [AROW-0510](#) and [AROW-0520](#)

Failure Conditions

These are the conditions in which a backup module will take over from a live module.

Loss of Gigabit Ethernet link

A loss Gigabit Ethernet link is detected by the physical interface when the Ethernet cable is removed or the connected switch or router loses power. The backup module will be notified of the loss of connectivity. Backup module becomes live as soon as it receives this message.

The only noticeable data repercussion is a network slow down while switch over happens.

Loss of power (catastrophic module failure)

When a backup module detects that the live/backup link goes down, it assumes the live module has lost power and immediately takes over as live module.

Data errors may occur as the live module fails as well as a network slow down while switch over happens.

When the module that was live regains power (or is replaced), it will receive settings from the now live module and become the standby module. If the module is in a high side slot and the low side socket is established, the optical links have to be re-established with a low side optical reset or temporarily taking the low side socket down.

Watchdog timeout (Functional module failure)

Live modules usually initiate ping messages resetting the watchdog timer on the backup module. If it times out, the backup module will send its own ping request. If still no response, the backup module assumes the live module is no longer active and takes over as live module.

The only noticeable data repercussion is a network slow down while switch over happens.

Loss of optical connectivity

If both live and backup optical connections go down, the live module has nowhere to send/receive data to/from. It will indicate this to the backup module which will take over immediately.

Data errors may occur as the optical links fail as well as a network slow down while switch over happens.

If optical reset commands do not fix the problem, the optical modules or cables have failed. Optical connections can only be serviced by SomerData staff. A spare unit should take over operation while the unit is out for repair.

Failover Mechanism

Any one of the failure conditions described above will cause the Backup module to take over from the live module automatically. Depending on the failure conditions, a certain amount of time may pass before the failure can be detected and some further action may be required to return AROW to a fully redundant system.

In all of the cases described in the following summary table, the diode will continue to function and transfer data. However, action has to be taken to bring AROW back to a fully redundant system.

A more detailed description is provided in the following

AROW Series *Data Diode*

| Failure condition | Failure detection speed (typical) | Possible Data corruption? | Further action required | Unit Service required |
|---|-----------------------------------|--|--|-----------------------|
| Low side Loss of Gigabit Ethernet link | 1 Second | No | Restore the Gigabit Ethernet link | No |
| High side Loss of Gigabit Ethernet link | 1 Second | Only If high side buffer over-runs | If AROW is being used at full bandwidth, the sending application may need to be throttled back to help the data buffer to get back to a safe level | No |
| Low side module failure | 100 microseconds | If data is being transferred over optics as module fails | The failed module should be replaced as soon as possible. | No |
| High side module failure | 100 microseconds | If data is being transferred over optics as module fails | The failed module should be replaced as soon as possible. Once the failure has been resolved, the optical links will have to be reset. | No |
| AC /DC Power unit failure | NA | No | The AROW unit will have to be serviced as soon as possible. | Yes |
| Optical link failure | 100 microseconds | If transfer as optics fails | The AROW unit will have to be serviced as soon as possible. | Yes |

Loss of GBE link

It typically takes 1 second to detect that a Gigabit Ethernet link had been lost.

High side

In the time period between the connection failure and the failure being detected, data arriving from the optical connection will be stored in the 2 Gigabit internal RAM buffer on both Live and backup modules. As soon as the failure is detected, the backup module will take over, send ARP messages to resolve IP/MAC bindings and continue to send data from the point at which the last acknowledge message was received.

At high data rates, the buffer will typically end up halfway full and will take a long time to recover. If the buffer is already half full or more as the error condition occurs, there is a high likelihood of the buffer over-running and data being lost.

Additional manual throttling of the sending application may be required to return the buffer to a "safe" level.

No data corruption is expected at lower data rates.

Low side

In the time period between the connection failure and the failure being detected, TCP segments sent to AROW are lost and will require (automatic) re-sending. When the sending socket has sent all the data it can send without acknowledgement, it will pause and hold the sending application until the backup module takes over.

The backup module takes over as soon as it has been notified of the failure by sending out an ARP request and periodic keep alive messages that will force the sending socket to acknowledge and resend lost data.

Once the lost data is resent, normal operation resumes.

To the end applications the switch over appear to be a network delay and no data is lost or corrupted.

Module failure

A module failure such as power supply failure can be simulated by removing the live module from its slot while an active TCP socket is connected. Compared to a loss of Gigabit Ethernet connectivity, detecting that the link between a live and backup module has been severed is very quick (within 100uS).

High side

As soon as a module failure condition is detected, the backup module will take over, send ARP messages to resolve IP/MAC bindings and continue to send data from the point at which the last acknowledge message was received.

Depending on when the failure occurs, a corruption may appear in the data.

Because the failure condition is detected very quickly, very little buffer will be used while the switchover happens. There should be no need to throttle back low side data rate.

The failed module should be replaced as soon as possible. Set up a replacement with the same control IP address as the failed module and insert it in the place of the failed module.

Optical connection will have to be reset (from the low side) before this module can become a fully functional backup module.

Low side

The backup module takes over as soon as it detects the failure by sending out an ARP request and periodic keep alive messages that will force the sending socket to acknowledge and resend lost data.

Once the lost data is resent, normal operation resumes.

To the end applications, the switch over appears to be a minor network delay.

Depending on when the failure occurs, a corruption may appear in the data at the high side.

The failed module should be replaced as soon as possible. Set up a replacement with the same control IP address as the failed module and insert it in the place of the failed module.

Optical connection will be reset automatically and the module receives its setting from the live module, so that the new module takes on the role of backup module as soon as possible.

Loss of Optical link

If both Live and backup optical links of the high side live module fail, it will notify the backup module, which will take over as soon as possible in the same manner as a module failure.

Data corruption can occur if data is being transferred as the optical links are failing.

AROW Series *Data Diode*

The optical links are not serviceable in a live situation so a replacement unit should take over as soon as possible, so that internal repairs can be made.

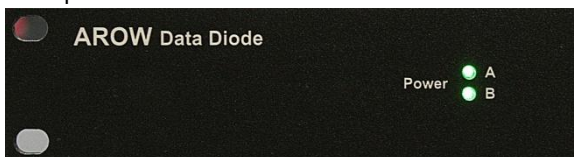
AC/DC converter failure

AROW has 2 AC to DC converters running in parallel. The unit can continue to function normally with 1 failed converter. However, the unit will have to be serviced to bring it back to full power redundancy.

AC to DC converter status is conveyed by 2 LEDs on the front panel and 2 on the rear. Both front and rear panels convey the same information.

When a power LED is illuminated, the corresponding AC to DC converter is functioning normally.

Front panel:



Rear panel:



8. CONTROL AND STATUS REFERENCE

In this Section

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Introduction

Control is via an Ethernet interface, so that controlling software can be run from a PC anywhere on a network to control and interrogate the status of the unit.

The external interface is 10BASE-T/100TX Ethernet with auto sensing.

Any application wishing to control AROW must open a TCP/IP socket connection with port 10001 of the control interface. Only one socket connection can be made at a time so when the application has finished, it must release the port. Any application attempting to connect to a connected port will be refused.

All AROW messages are 9 Bytes long: The first Byte is the Start of Message marker byte, the second read or write flag byte, the 3rd and 4th are the addressing word, the 5rd to 8th are the data payload bytes and the last byte is the end marker byte.

Any command sent is reflected back by AROW to confirm that the command has been received and acted upon.

There is no unsolicited status. All status must be collected by sending a status request command.

Connecting to AROW's Control and Status Port

Connection to AROW's control and status Port are made with a standard TCP/IP socket. This socket connection is to port 10001

Only one Application can open a socket at a time so if a second application attempts to create a socket connection it will be refused.

When the application has finished controlling AROW, it should release the socket connection so that another application can have access to it.

Protocol

Messages between AROW and the controlling application should follow a request/response model. The application should request that a command be executed or that a status word be collected. AROW responds with the executed command or the status requested.

Commands

Only one command should be sent at one time. The application should wait until the response to the command has been received before moving on to the next command or status request.

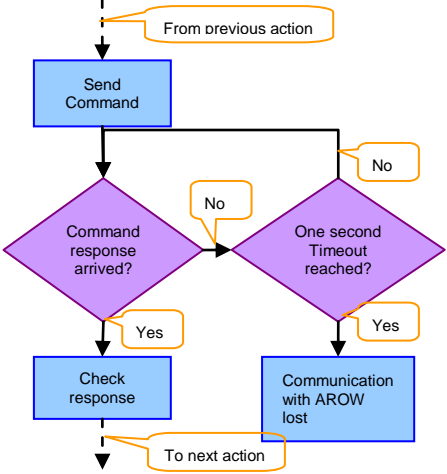


Figure 8-1: Command Flow Diagram

Status requests

Only one status request should be made at one time. The application should wait until the status of the request has been received before moving on to the next command or status request.

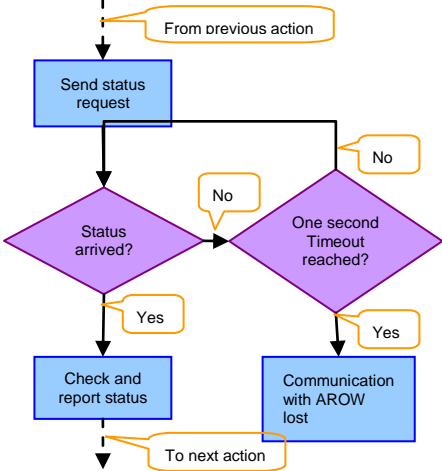


Figure 8-2: Status Flow Diagram

Control and status Python script

A python script is provided as an easy starting point to setting up and controlling AROW.

use this script to set the data port IP address, collect various status and perform resets.

The following is the "-h" output.

```
./control_aron_tcp.py -h
usage: control_aron_tcp.py [-h] [--version] [-t] [-o] [-m]
                           [-D] [-s] [-i [IPADDR]] [-M]
                           [-a ADDR] [-d DATA] [-H HOST]

Controls and collects status from AROW

optional arguments:
  -h, --help                show this help message and exit
  --version                 show program's version number and
                           exit
  -t, --tcp_rst             reset the tcp stack
  -o, --optics_rst         reset the optical link
  -m, --hightide_rst       reset the ddr buffer high tide mark
                           and the buffer overrun counters
  -D, --defaults           set all NV registers to default
                           values
  -s, --status              collect status
  -i [IPADDR], --ipaddr [IPADDR]
                           Sets (or gets when no IP address
                           provided) the IP address of the data
                           port. dotted ip address string
  -M, --mac                gets the MAC address of the data
                           port.
  -a ADDR, --addr ADDR     hexadecimal (`0010` for example)
                           representation of the address of the
                           register to access
  -d DATA, --data DATA   hexadecimal (`00100000` for example)
                           representation of the register to
                           write. If no -d is specified, a read
                           access is implied
  -H HOST, --HOST HOST     IP address of control port.
                           Default is '192.168.2.220'
```

Setting the data port IP address

Assuming AROW's control port is 192.168.2.221,

```
./control_aron_tcp.py -H 192.168.2.221 -i 10.0.0.51
```

will set the data port IP address to 10.0.0.51.

Resetting the tcp stack.

If AROW's data port ever becomes unresponsive, its TCP stack can be reset with the following command.

```
./control_arow_tcp.py -H 192.168.2.221 -t
```

Control and Status message format

All AROW messages are 9 bytes long: the 1st byte is the "Start of Message" marker, the 2nd byte is the read/write flag byte, the 3rd and 4th bytes are the register address, the 5th to 8th are the Data payload bytes and the last byte is the End of message marker.

| Message field name | SOM | Rd_wr | addr | Data | EOM |
|--------------------|------|----------------------------------|------------------|------|------|
| Number of bits | 8 | 8 | 16 | 32 | 8 |
| value | 0x53 | 0x00 for read, 0x01 for write | Register address | Data | 0x0d |

Bytes are sent Least significant bit first.

Where a field is more than 8 bits, the MSbyte is sent first.

Registers that are not implemented will return all 1s in the data field.

Any message that doesn't conform to the format above will be ignored and discarded.

Memory map

| Address range | Type |
|-------------------------|---|
| 0x0000 to 0x0FFF | System control and status (0x0100-0x010F is Non volatile) |
| 0x1000 to 0x1FFF | TCP/IP stack (0x1000-0x100F is Non volatile) |
| 0x2000 to 0x2FFF | MAC core (0x2400-0x241F and 0x2700-0x270F are non volatile) |
| 0x3000 to 0xFFFF | Reserved |

Registers

System registers

Table 8-1 Part Number register (0x0000)

Valid from firmware V0R1

| Bit | field | mode | Default Value | Description |
|------|----------|------|---------------|-------------------|
| 31:0 | Part_num | RO | 0xa0a00112 | Part number field |

Table 8-2 Version and Revision register (0x0001)

Valid from firmware V0R1

| Bit | field | mode | Default Value | Description |
|-------|---------|------|---------------|-----------------------|
| 31:16 | ver_num | RO | 0x0000 | Version number field |
| 15:0 | Rev_num | RO | 0x0001 | Revision number field |

Table 8-3 Serial number low (0x0002)

Valid from firmware V0R1

| Bit | Field | mode | Default Value | Description |
|------|-----------|------|---------------|----------------------------|
| 31:0 | Ser_num_L | RO | 0x89abcdef | Low Dword of serial number |

Table 8-4 Serial Number high (0x0003)

Valid from firmware V0R1

| Bit | Field | mode | Default Value | Description |
|------|-----------|------|---------------|-----------------------------------|
| 31:0 | Ser_num_H | RO | 0x01234567 | High DWord of Serial Number Field |

Table 8-5 commit number (0x0004)

Valid from firmware V0R2

| Bit | Field | mode | Default Value | Description |
|------|--------|------|---------------|-------------------------------------|
| 27:0 | commit | RO | 0x00000000 | Revision system (git) commit number |

Table 8-6 hardware status (0x0005)

Valid from firmware V0R5

| Bit | Field | mode | Default Value | Description |
|-----|------------------------|------|---------------|--|
| 0 | Module is High | RO | - | Module is in a high side slot. 0 = module is in a low side (dirty) slot. |
| 1 | Module in live slot | RO | - | Module is in a live slot. 0 = module is in a backup slot |
| 2 | Module is live | RO | - | Module is currently the live module. (even if it is in a backup slot). 0= the other module is a live module and we are backup. |
| 3 | Live-backup link is up | RO | - | Link between live and backup modules is up. |
| 16 | Stand-alone module | RW | 0x0 | 1 = Module is live and is for use in non redundant systems. 0 = Module to be used in a redundant system; it expects another module alongside it and will produce or receive both a live and backup stream of optical data. |
| 17 | Reset live/backup link | RW | 0x0 | Reset the Live/backup duplex link |

Table 8-7 optical link (0x0100)

Valid from firmware V0R4

| Bit | Field | mode | Default Value | Description |
|--------|---------------------------|------|---------------|--|
| 0 | Live Link up | RO | - | Live Optical Link has been established |
| 1 | Backup Link up | RO | - | Backup Optical Link has been established |
| 16 | Reset Live Optical link | RW | 0x0 | Reset the live optical link |
| 17 | Reset backup Optical link | RW | 0x0 | Reset the backup optical link |
| others | reserved | RO | 0x0 | |

TCP/IP stack registers

Table 8-8 MAC address Low (0x1000)

Valid from firmware V0R1

| Bit | Field | mode | Default Value | Description |
|------|----------------|------|---------------|---|
| 31:0 | MAC_ADD_LOW | RO | 0xC25DD000 | LOW DWord of Mac Address Field for data port |
| 28 | Set low bits | RW | 0x0 | Saves bits 11:0 of Mac address to Non volatile memory |
| 11:0 | MAC_ADD_RAN GE | RW | 0x000 | The factory settable bits of the Mac address |

Table 8-9 MAC address High (0x1001)

Valid from firmware V0R1

| Bit | Field | Mode | Default Value | Description |
|------|--------------|------|---------------|--|
| 15:0 | MAC_ADD_high | RO | 0x0050 | High Word of Mac Address Field for data port |

Table 8-10 IP address (0x1002)

Valid from firmware V0R1

| Bit | Field | Mode | Default Value | Description |
|------|------------|------|---------------|-------------------------|
| 31:0 | Ip_address | RW | 0x0000 | IP address of data port |

Table 8-11 tcp_ip controls and flags(0x1003)

Valid from firmware V0R1

| Bit | Field | Mode | Default Value | Description |
|--------|------------------------------|------|---------------|---|
| 0 | TCP est | RO | 0x0 | TCP socket connection has been established with the data port. |
| 1 | GBE SFP present | RO | 0x0 | Gig Ethernet SFP module has been detected |
| 2 | Link-up | RO | 0x0 | Gig Ethernet link is up |
| 3 | DDR full | RO | 0x0 | Buffer is full - loosing data. |
| 16 | Reset tcp/ip stack | RW | 0x0 | Reset the tcp/ip stack. Normal operation is 0x0 |
| 17 | Reset fifo overrun byte cnt | RW | 0x0 | Reset the byte counter that counts the number of bytes that were lost because of a Fifo full condition. |
| 18 | Reset ddr overrun byte count | RW | 0x0 | Reset the byte counter that counts the number of bytes that were lost because of a buffer full condition. |
| 19 | Reset high tide mark | RW | 0x0 | Reset the DDR buffer high tide mark |
| others | Reserved | RO | 0x0 | |

Table 8-12 Network gateway IP address (0x1004)

Valid from firmware V0R1

| Bit | Field | Mode | Default Value | Description |
|------|------------|------|---------------|-----------------------------------|
| 31:0 | Ip_address | RW | 0x00000000 | IP address of the network gateway |

Table 8-13 Network Mask (0x1005)

Valid from firmware V0R1

| Bit | Field | Mode | Default Value | Description |
|------|------------|------|---------------|--------------|
| 31:0 | Ip_address | RW | 0x00000000 | Network mask |

Table 8-14 FIFO overrun bytes counter (0x1010)

Valid from firmware V0R1

| Bit | Field | mode | Default Value | Description |
|------|----------------------------|------|---------------|---|
| 15:0 | Fifo Overrun bytes counter | RO | 0x0000 | Number of bytes that have been lost because of a fifo full event. Pegs at 0xFFFF. Reset with "reset FIFO overrun byte cnt" register |

Table 8-15 DDR overrun bytes counter (0x1011)

Valid from firmware V0R1

| Bit | Field | mode | Default Value | Description |
|------|---------------------------|------|---------------|--|
| 31:0 | DDR Overrun bytes counter | RO | 0x00000000 | Number of bytes that have been lost because of a buffer full event. Pegs at 0xFFFFFFFF. Reset with "reset DDR overrun byte cnt" register |

Table 8-16 bytes in buffer (0x1012)

Valid from firmware V0R1

| Bit | Field | mode | Default Value | Description |
|------|---------------------------|------|---------------|--|
| 31:0 | Bytes currently in buffer | RO | 0x00000000 | Number of bytes currently in the buffer. Maximum is 0x07FFFFFF in the prototype, 0x0FFFFFFF in the final product. |

Table 8-17 high tide(0x1013)

Valid from firmware V0R1

| Bit | Field | mode | Default Value | Description |
|------|----------------|------|---------------|--|
| 31:0 | High tide mark | RO | 0x00000000 | Number of bytes in the buffer when the buffer was at its fullest. Maximum is 0x0FFFFFFF . Reset with "reset high tide mark" register |

MAC core registers

Provides network connectivity statistics, refer to Xilinx UG777, Base address is 0x2000

9. Firmware update

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Introduction

It is possible to update the firmware of the network interface modules to add or change functionality through Internal USB programming ports.

If you think that you require a firmware update, please contact SomerData support first.

Before you begin

Do not attempt to update the firmware unless SomerData has requested you do so.

To access the programming ports, AROW's case cover needs to be removed, or the individual module removed and set into an open case to provide power..

This will require the unit be removed from any rack and placed in a working area large enough to enable easy access.

Tools

- a 2mm allen key (hex key)
- a receptacle to store screws
- a USB A to mini USB cable of appropriate length

- an IEC power lead
- a PC (windows or linux) with the required software installed
- the update firmware ".bin" file

The PC that will be performing the update may run either Linux or Windows operating systems. SomerData supplies an executable for Windows operating system or a script for Linux operating systems

Accessing the programming ports

Remove Top Cover

Remove any power supply cable from the unit.

Remove the top cover of the unit. To do so, unscrew the 24 screws using a 2 mm allen key. Keep the screws safely in a receptacle, to prevent loss.

locate programming ports

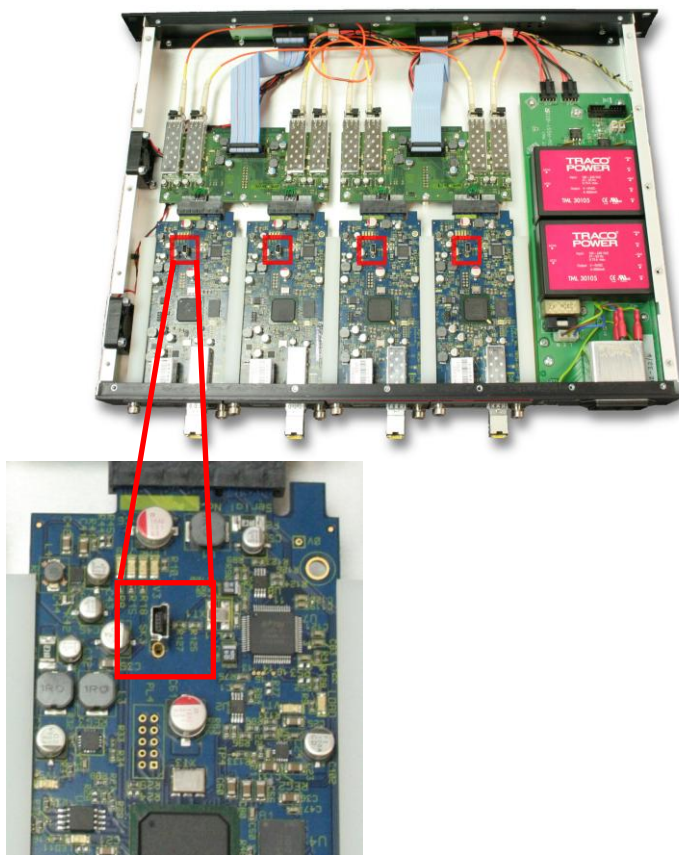


Figure 9-1 Location of the USB programming ports

Each Network interface module has a vertical Mini USB socket. Plug in the USB mini cable between the computer that will be programming the flash and the module to be programmed.

Apply power

Making sure that no foreign object is in the AROW chassis, and keeping fingers clear of any internal part, connect the IEC lead to AROW and apply power.

Programming the flash memory

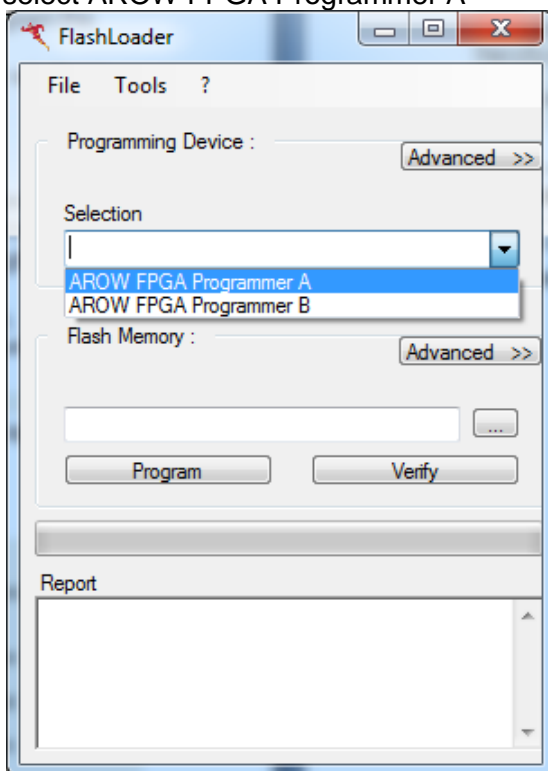
Windows

You will require SomerData's "flashloader.exe" to program the flash.

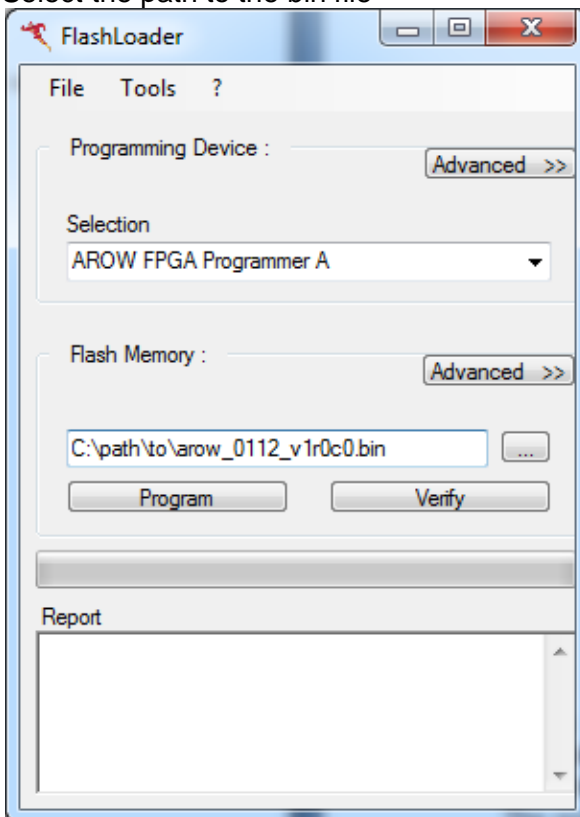
You will also require the FTDI D2XX driver, available from <http://www.ftdichip.com/Drivers/D2XX.htm>

flashloader.exe requires administrator rights to run on Windows Vista, Windows 7 or greater.

1. select AROW FPGA Programmer A



2. Select the path to the bin file



3. click program

The process takes about 1 minute

a successful run will report the following:

```
30/08/2012 15:33:30 ==> Start creating back up ...
Creating back up done : successful
30/08/2012 15:33:33 ==> End of creating back up

30/08/2012 15:33:34 ==> Start erasing chip ...
Erasing chip done : successful
30/08/2012 15:33:34 ==> End of erasing chip

30/08/2012 15:33:34 ==> Start programming ...
```

```
Programming done : Successful
30/08/2012 15:34:15 ==> End of programming

30/08/2012 15:34:16 ==> Start Verifying ...
Verifying done : Binary file is the same in the flash memory
30/08/2012 15:34:18 ==> End of verifying

30/08/2012 15:34:23 ==> Start creating back up ...
Creating back up done : successful
30/08/2012 15:34:26 ==> End of creating back up

30/08/2012 15:34:26 ==> Start erasing chip ...
Erasing chip done : successful
30/08/2012 15:34:26 ==> End of erasing chip

30/08/2012 15:34:26 ==> Start programming ...
Programming done : Successful
30/08/2012 15:35:08 ==> End of programming

30/08/2012 15:35:08 ==> Start Verifying ...
Verifying done : Binary file is the same in the flash memory
30/08/2012 15:35:11 ==> End of verifying
```

You will need to close the program, move the programming USB cable to the next port the re-launch flashloader.exe

Linux

You will require "flashrom" v0.9.2 or greater to program the flash, available for download from <http://flashrom.org/Downloads>

The script "flash_arow.sh" will automatically run through the process of programming the flash.

As an example assuming you are going to use arow_0112_v1r0c0.bin, from a command line terminal, in a folder in which you have write access, run:

```
./flash.sh /path/to/arow_0112_v1r0c0.bin
```

The script will run a few checks, pad the bin file to an appropriate length and use the padded file to program the flash.

The process takes about 2 minutes.

A successful run will end with the following output:

```
....
Calibrating delay loop... OK.
Found chip "Winbond W25Q16" (2048 KB, SPI) at physical
address 0xffe00000.
===
This flash part has status UNTESTED for operations: PROBE
READ ERASE WRITE
The test status of this chip may have been updated in the
latest development
version of flashrom. If you are running the latest
development version,
please email a report to flashrom@flashrom.org if any of the
above operations
work correctly for you with this flash part. Please include
the flashrom
output with the additional -V option for all operations you
tested (-V, -Vr,
-Vw, -VE), and mention which mainboard or programmer you
tested.
Thanks for your help!
===
Flash image seems to be a legacy BIOS. Disabling checks.
Writing flash chip... Erasing flash before programming...
Erasing flash chip... SUCCESS.
done.
COMPLETE.
Verifying flash... VERIFIED.

cleaning up
```

Firmware update:Finishing

Check firmware update has been applied

To load the content of the updated flash, AROW needs to be power cycled.

Once the power has been re-applied, check that the version number, revision number and commit number match the numbers on the bin file you have used by running `./control_AROW_tcp.py -H <IP address of control port> -s` for example:

```
./control_adow_tcp.py -H 192.168.2.223 -s
part number: a0a00112
serial number: 01342d4aa73f0ca2
firmware version: 1 revision: 0 commit: 0x0000000
...
```

If the numbers do not match try programming the flash again. for any further help, contact SomerData support.

Secure Top Cover

Remove the power IEC connector form AROW

re-place the cover, lining up the screw holes with the holes in the cover.

Fasten the 24 screws using a 2mm Allen key (Hex key).

re-install the system in your network

10. Troubleshooting

Basics

The front and rear panel LEDs can give diagnostic information for troubleshooting. See section 6 for details.

Most connectivity problems are due to routing issues.

Check the routing tables on your networks to ensure that a valid path exists between all nodes. See the installation and Operation sections for details and example routings.

If possible, check connections by bypassing AROW

Fibre connectors

Do check that the correct grade of fibre is being used, especially on longer connection runs. Optical connections are sensitive to both overdrive and underdrive, so often incorrect signal levels can give rise to obscure problems such as occasional packet loss or packet loss at high data rates. If possible, use a fibre optic cable checker to determine signal levels and quality.

Copper Connections

Please ensure that good quality screened CAT6 Ethernet cables suitable for full-rate GBE connections are used.

System Integration

When mounting in a rack, or in proximity to other electrical equipment, please ensure that normal system integration procedures are followed.

System integrators should ensure that the unit is not operated out of its specification range, that cable and power connections are routed to prevent interference, that correct start-up and shut-down procedures are followed before system connections are altered and that all electrical and safety procedures that apply in your territory or application area are followed.

In particular, be aware that electro-static and electro-magnetic disturbances may affect performance or damage the equipment and /or data integrity and take steps to prevent these.

Consult a systems integration specialist if in doubt.

Connection Sequence

Advanced Problems

For more advanced problems, call us for assistance – 44(0)1179 634050 or support@somerdata.com . Please ensure that you have followed the [Support](#) section instructions to allow a speedy resolution of your problem.

11. SPECIFICATIONS

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Introduction

AROW comprises a mechanical "1U" rack chassis containing circuitry on a number of printed circuit boards, including:

- Power supply
- 2 Signal routing and optical connection boards
- Network interface modules
- Status LED Boards

Physical

Dimensions

Length 360mm x Width 482mm x Height 44mm

NB the overall envelope required will be larger than this to accommodate rear panel connections and bend radius requirement for cables. Note also that sides should not be fully obstructed since cooling vents are used.

Environmental

Temperature (Operating)

0°C to 50°C

Temperature (Storage)

-20°C to +85°C

Note: In common with all electronic equipment, allow suitable stabilisation time when moving from extreme storage to operating conditions before powering on the unit, especially where condensation might be expected to form. DO NOT operate the unit if condensation is present.

Relative Humidity (Operating)

5% to 95% non-condensing

Shock and Vibration

suitable for normal commercial transport when using the original factory packaging

Power

Supply

Operating Voltage: 90V to 240 V

Operating Frequency: 49 to 61 Hz

Connector

Standard 3-pin IEC connector

Consumption

30VA Maximum

Control and Status port

| | |
|---------------|-------------------------|
| Input/Output: | Ethernet 10Base-T/100TX |
| Connector: | RJ-45 (CAT-5) |

Data port

Copper Gigabit Ethernet SFP module

| | |
|--|---------------------|
| Input/Output: | Ethernet 1000Base-T |
| Connector: | RJ-45 (CAT-5e) |
| Cat-5e or Cat-6 screened cables are recommended. | |

Fibre Gigabit Ethernet SFP module (optional)

| | |
|---------------|----------------------|
| Input/Output: | Ethernet 1000Base-SX |
| Connector: | Duplex LC |

The fibre Gigabit transceivers are Class 1 Laser Products and comply with US FDA regulations. These products are certified by TÜV and CSA to meet the Class 1 eye safety requirements of EN (IEC) 60825 and the electrical safety requirements of EN (IEC) 60950.

Recommended connection cables – 9/125 terminated with LC connectors

USB Programming Interface Compatibility

USB 2.0.(Full speed)

USB connector type: Mini B

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12. SUPPORT

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What to do if you have a problem

Firstly, please ensure that you have followed the installation, connection and operation instructions in the appropriate User Guide.

Also, check the Troubleshooting section (where appropriate) to eliminate common problems.

Servicing, Maintenance and Repairs

Please contact your supplier or SomerData for all questions relating to maintenance and repairs.

Any unauthorised attempt to open, modify or otherwise repair the product will invalidate the SomerData warranty and may result in the product being left in an irreparable condition.

If you need Support

For warranty, technical and application support issues, you should initially contact your supplier to check whether your SomerData product is covered by warranty, extended warranty or maintenance contract.

At SomerData, we will make our best efforts to provide prompt and friendly support by phone, fax and e-mail.

Diagnosing a problem will require your co-operation and we expect you to provide a detailed description of the problem in the form of a detailed Fault Report.

Support Requests

When contacting SomerData for support, please provide as much information as possible about the problem or issue for which you require assistance.

We will be able to deal with your request more efficiently if you provide the following details (where available) in your Fault Report:

- Part Number or Model Number
(for example AROW-0112)
- Serial Number (for example 2010/01/001)
- Software Version (for example 2.0)
- Details of any symptoms or error messages
- Diagnostics information (if available)
- Sequence of events/actions or other circumstances that triggered the problem
- How you are able to identify that there is a problem
- How you have been able to measure, log or otherwise display the problem
- Details of the host PC (if appropriate) including: operating system; hardware configuration; other software applications (e.g. analysis or processing programs) that are running at the same time
- Sample data files (if appropriate)

When we acknowledge your support request, you will be given a *Support Tracking Number* (STN), which should be quoted in all further correspondence relating to that specific support request.

Returns

Please do not return any products to SomerData without first contacting SomerData and obtaining a Return Merchandise Authorisation (RMA) Number. Goods returned without a RMA will be subject to a handling charge and returned unopened.

This will ensure that the processing of any repair or upgrade is handled efficiently and in accordance with any agreed action.

If the SomerData product is under warranty, repairs are free-of charge. If not, there will be a repair charge, which will comprise an initial evaluation fee and quotation, followed by repair and parts (if authority is given to carry-out the repair).

Pack the item in its original packaging. If the original packaging is not available, it must be packed in such a way to avoid transit damage. Damage sustained in transit is not covered under warranty.

Returned goods should be accompanied by documentation that indicates the RMA Number along with a detailed fault report and contact details (name, organisation, phone, fax and e-mail).

Mark the RMA Number on the outside of the package.

Ship the item by insured, prepaid carrier to the above address.

Items being returned from outside the European Community must be accompanied by a Commercial Invoice. This should include a description of the goods, value for Customs Purposes and state that the goods are being temporarily returned to the UK for repair. SomerData will not accept liability for UK importation costs resulting from inadequate documentation.

SomerData Contact Information

Address: Somerdata Limited
Underwood Business Park
Wells
BA5 1AF
England

Phone: UK 01179-634050
International +44 1179-634050

E-Mail: support@somerdata.com

Website: www.somerdata.com

End-of-Life Disposal

Your SomerData product may be returned to SomerData at the end of its life provided that the product is free from radiation or biological contaminants and that no other legislation forbids the return. The end user is responsible for all shipping costs and the Returns procedure should be followed.

Waste Electrical & Electronic Equipment (WEEE)

In the UK, Somerdata products may be recycled free of charge at any local authority recycling centre as long as the SomerData logo appears on the product and the following WEEE producer registration number is quoted: WEE/HA0074UR/PRO.



13. WARRANTY

In this Section

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| WARRANTY: TERMS AND CONDITIONS | 13-1 |

Introduction

This section describes SomerData's Warranty Terms and Conditions.

Where the SomerData product has been supplied via an authorised Reseller, the Warranty and Support is between SomerData and its Reseller. Local Warranty and Support arrangements should be agreed between the Reseller and the Customer.

The following information is subject to change without notice.

Warranty: Terms and Conditions

SomerData warrants all goods supplied by it to be free from defects in material and workmanship, under normal use, care, storage and service, for a maximum period of twelve months from the date of delivery (per Incoterms 2000) by SomerData.

This warranty is limited to the repair or replacement, as SomerData may elect and at an establishment authorised by it, of such items as shall appear to SomerData, upon inspection to have been defective in material or workmanship.

All decisions relating to the validity and processing of Warranty claims shall be at the sole discretion of SomerData.

This warranty does not apply to normal maintenance service or to normal replacement of service goods.

Any claim under this warranty shall expire unless made in writing immediately after the appearance of a claimed defect.

This warranty excludes damage from incorrect installation, unauthorised modification, negligence, misuse or abuse or any item of equipment which has been serviced or worked on by anyone other than SomerData or its authorised representative.

SomerData will repair or replace, at its option, any product purchased from SomerData which, under normal conditions of use and service, proves to be defective in material or workmanship.

No charge will be made for labour or parts with respect to defects covered by this warranty, provided that the work is done by SomerData.

This warranty does not cover expenses incurred in the removal or reinstallation of any SomerData products, whether or not proven defective

Replacement or repairs furnished under this warranty are subject to the same terms and conditions of the original warranty.

14. NOTICES

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General Information

Copyright © 2012 Somerdata Ltd. All Rights Reserved.

This publication is protected by copyright and all rights are reserved. No part of it may be reproduced or transmitted by any means or in any form, without prior consent in writing from SomerData.

The information in this User Guide has been carefully checked and is believed to be accurate. However, SomerData assumes no responsibility for any inaccuracies that may be contained in this publication.

In no event will SomerData be liable for direct, indirect, special, exemplary, incidental, or consequential damages resulting from any defect or omission in this manual, even if advised of the possibility of such damages.

In the interest of continued product development, SomerData reserves the right to make improvements in this publication and the products it describes at any time, without notice or obligation.

All product names mentioned herein are used for identification purposes only, and may be the trademarks or registered trademarks of their respective companies.

Somerdata and the Environment

SomerData is committed to design and introduce products that conform to applicable environmental legislation and standards.

One of our missions is to integrate environmental stewardship into the business of providing quality products, services, and customer support at the best value.

In order to achieve this, SomerData has established a strategic team to focus on the importance of meeting our environmental obligations in the design, manufacture and support of our products.

We have developed a broad appreciation of the impact of these directives on our entire business model, from technical processes for materials, to finished goods manufacturing.

Current Compliance Activities

The Company's current environmental compliance commitment has been structured to meet the following European Union directives:

- Restriction of use of Hazardous Substances or RoHS Compliance (EU Directive 2002/95/EC)
- Waste Electrical & Electronic Equipment or WEEE Compliance (EU Directive 2002/96/EC)

Our goal is to meet or exceed compliance obligations of these EU directives.

Restriction of use of Hazardous Substances (RoHS)

Somerdata has also established a RoHS qualification process to help ensure that products meet stringent reliability and quality requirements, as well as regulatory compliance requirements.

The maximum allowable hazardous substance at a homogeneous material level under the EU RoHS Directive is shown in the following table.

From 1st July 2006 all SomerData manufactured products used lead-free soldering

| Substances | Maximum Concentration Values (ppm) |
|--|--|
| Lead and its compounds | 1000 |
| Mercury and its compounds | 1000 |
| Hexavalent Chromium (Cr+6) | 1000 |
| Cadmium and its compounds | 100 |
| PolyBrominated Biphenyls (PBBs) | 1000 |
| PolyBrominated Diphenyl Ethers (PBDEs) | 1000 |

Declaration of Conformity

Name of Manufacturer: Somerdata Ltd.
Address of Manufacturer: Somerdata Ltd
1 Riverside Business Park
Bristol

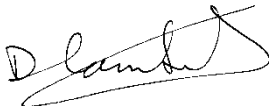
BS4 4ED
United Kingdom
Equipment description: AROW Network Data Diode
Model: AROW-610,510,520

Conforms to the following Product Specifications:

Safety: IEC 950

EMC: 89/336/EEC EN55022 Harmonised Standard

The product complies with the requirements of the Electromagnetic Compatibility Directive 89/336/EEC as amended and the Low Voltage Directive 73/23/EEC and carries the CE marking accordingly.



Signed:
Position: Technical Director
Date: 19th June 2012

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