A. W. Communication Systems Limited

TR*ip*2

IP gateway for four-wire analogue circuits used in the PMR industry

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Summary:

This document contains the specification for a TR*ip*2 gateway to connect four-wire analogue private circuits to a 10/100 Mbps Ethernet LAN connection for the purpose of carrying full-duplex 3.4 kHz audio bandwidth information over an IP connection.

Note: This version of the manual only applies to TRip2 versions 2.2.0 onwards. If you have an earlier version of TRip2 firmware, we recommend that you update to the latest version. The update procedure in this manual still applies to older versions of TRip2 firmware.

Contents

1.   References

1) RFC3550 – RTP: A Transport Protocol for Real-Time Applications [July 1003]
2) draft-eitf-avt-profile – RTP Profile for Audio and Video Conferences with Minimal Control [March 2003]

2.   Scope

This document describes the TR*ip*2, a gateway suitable for interfacing the following over a 10/100 Mbps Ethernet LAN:

- Four-wire analogue circuits,
- RS-232 serial data, and
- 9 active-low logic levels, including one PTT logic circuit.

The TR*ip*2 replaces for the original TR*ip* unit, which is now obsolete. TR*ip*2 units are compatible with original TR*ip*2 units, as long as the audio codec used is not changed from its default setting of 64 kbits/s (G.711 A-law compression). In addition, the physical interface to the TR*ip*2 is identical with that of the original TR*ip* unit, with the exception that the internal pull-ups on the logic pins are now referenced to +3.3 V, not +5 V as in the original TR*ip*.

3.   Introduction

For historic reasons the PMR (private mobile radio) market has often used four-wire analogue circuits provided by the local telecoms provider to carry audio between operators and remotely situated transmitters.

The increasing availability of low-cost "always-on" IP connections has raised the possibility that these links can be replaced using a packet-based connection, rather than the direct physical connection provided by the older four-wire analogue circuits.

The TR*ip*2 is specifically designed to satisfy the requirements of the industry for a device that can interface between existing operator/transmitter switch equipment that has a four-wire audio interface and an IP network capable of carrying the audio traffic packet data.

This document will describe the form, features and functionality of a standalone TR*ip*2 unit.

4.   Technical Specification

4.1.   Internet Protocol and Application Features

The TR*ip*2 provides support for the following IP features to enable the unit's operation:

- IP   Internet Protocol, the base network protocol by using all higher-level protocols
- QOS   Quality of Service for IP packets
- UDP   User Datagram Protocol, an unacknowledged transport protocol
- TCP   Transmission Control Protocol, an acknowledged transport protocol
- RTP   Real-Time Transport Protocol, for the transmission of real-time audio data
- RTCP   RTP Control Protocol, for the monitoring of RTP
- ICMP   Internet Control Message Protocol, for network management and discovery
- SSH[1]   Secure Shell, for terminal emulation to configure the TR*ip*2
- FTP   File Transfer Protocol, for retrieving TR*ip*2 updates
- TFTP   Trivial File Transfer Protocol, for retrieving TR*ip*2 updates
- HTTP   Hyper-Text Transfer Protocol, for retrieving TR*ip*2 updates

The support for each protocol is discussed in each interface section it is used to support.

4.2.   Logical Interface Architecture
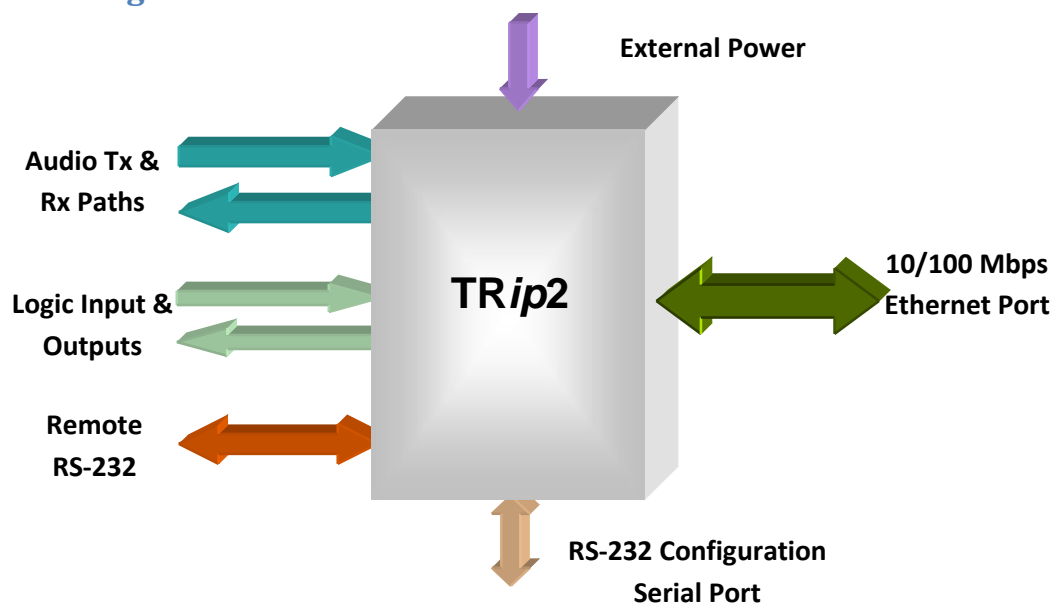
Figure 1: Logical Interface Arhitecture

The TR*ip*2 has a logical interface architecture as shown in Figure 1.

The audio TX and RX paths are designed to imitate the physical interface provided by a 600 Ω four-wire audio interface. The audio RX is compressed and transmitted across the network using RTP over UDP, and audio received from the network is decompressed and played out of the audio TX path. Only the default compression algorithm is suitable for transmission of tones, so an extra serial interface

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[1] The SSH support in TR*ip*2 is intended to replace the less secure TELNET protocol in the original TR*ip* unit. TELNET is still supported, but we recommend you use an SSH client (such as PuTTY, freely available at http://www.chiark.greenend.org.uk/~sgtatham/putty/), especially on untrusted networks, such as the Internet.

and an extra logic control interface are provided to allow transmission of transmitter control information through these interfaces rather than over the audio path.

4.3. Operational Scenarios

The unit is deployed in a point-to-point configuration. Within this configuration there is normally a *master* and a *slave* unit. The master unit would normally be associated with the control site, and is capable of having an input pin that is used to control the state of the remote transmitter (i.e. transmitting/not transmitting). On the remote unit this pin would be an output, and defines the unit as a slave unit.
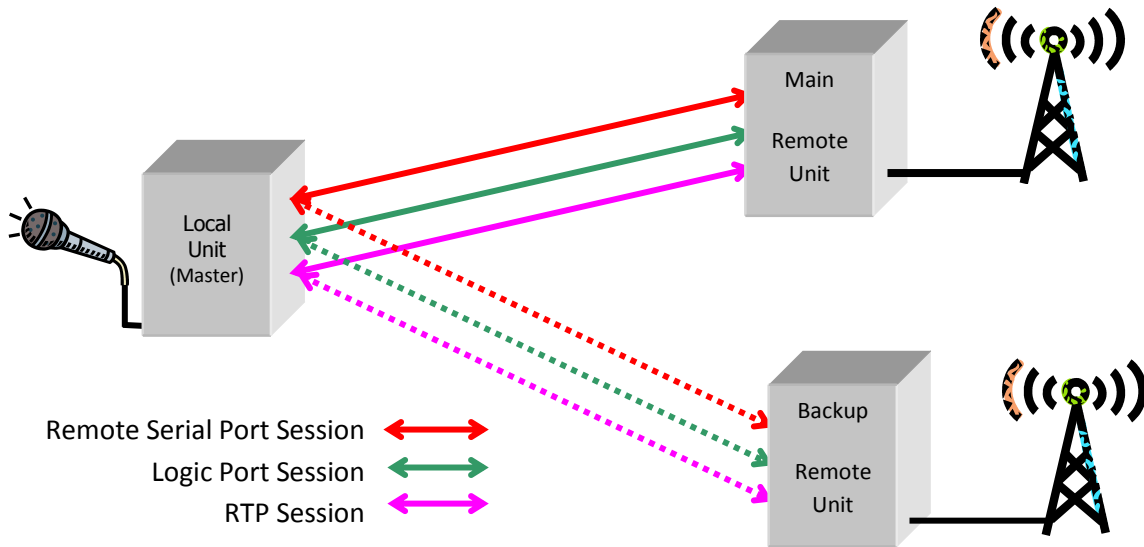
Figure 2: Main/Backup Operation

Each unit can also be configured with main and backup remote unit details.

The master unit can be switched between remote units using one of the logic input pins as a control, or via the command-line interface for more permanent selection.

A master or slave unit can only receive IP data from one IP address (unit) at a time. All other IP data sources will be ignored, except for ICMP ping and SSH/TELNET traffic. The accepted source IP address can be either the main or backup remote unit IP address, and this choice is based on the current setting provided in the command-line parameter or, from the logic control port pin if this option is enabled.

4.4. Interface Descriptions

4.4.1. Audio Interface

Functional

Supported Compression Algorithms
The audio interface provided by the TR*ip*2 takes a single analogue receive audio path with a bandwidth between 300 Hz and 3400 Hz and compresses it using its internal codecs. The following audio codecs are supported:

Codec	Network Data Rate	RTP Payload Type
G.711 A-law (default)	64 kbps	8
G.726	40 kbps	96
G.726	32 kbps	97
G.726	20 kbps	98
G.726	16 kbps	99
Speex	8 kbps	100

Table 1: Supported Audio Codecs

Note: The network data rates shown above are for the audio payload only, and does not include IP/UDP/RTP packet overhead - see section 7 "Audio Codec Bandwidth" for network bandwidths required in practice.

Unlike the original TR*ip*, the codecs and data rates do not need to be the same in both directions: The TR*ip*2 will encode audio data with the settings it is configured with, but will decode the data it receives based on the RTP payload type in the RTP packets it receives.

Sampling Period

The sampling period can be set to between 5 and 30 ms for any of the codecs listed in Table 1: Supported Audio Codecs apart from Speex, which ignores this setting as it uses 30 ms packets only.

IP Protocol Support

The compressed audio data is encapsulated and transmitted over an IP network using RTP version 2, as described in RFC3550 (see section 1 above). The RTP data will be carried using UDP over IP.

Each unit maintains both a local and a remote alarm status for both RTP and RTCP streams. If a local alarm is triggered, the red alarm LED on the unit will be turned on, which will automatically be turned off when all alarms are cleared. If the SMTP parameters of the unit are correctly configured, an email will be sent when a remote alarm has been triggered, and another when it has cleared.

- An **RTP alarm** is triggered if there is a period of time in excess of the *RTP local delay* or *RTP remote delay* values (see Table 16) when no RTP packets are received.
- An **RTCP alarm** is triggered if there is a period of time in excess of the *RTCP local delay* or *RTCP remote delay* values (see Table 16) when either (i) the average values of RTCP jitter, loss or delay values exceed the values in the *RTCP jitter*, *RTCP loss* or *RTCP delay* variables respectively, or (ii) no RTCP packets are received.

The TR*ip*2 supports a single duplex RTP stream using UDP over IP. The IP address and UDP port number that the TR*ip*2 sends/receives data to/from can be configured to be different when the unit is in main and backup mode (names in italics refer to variables set through the command-line interface – see section 5.6.10):

Unit Remote Setting	IP Address Used	UDP Port Used
Main	*Unit Main Address*	*RTP Main Port*
Backup	*Unit Backup Address*	*RTP Backup Port*

Table 2: RTP Transport Address Parameters

The RTP port number may be any even UDP port number above 5000, and the RTCP port number is always one above the RTP port number.

By default the port numbers used for both main and backup RTP and RTCP UDP streams are 5004 and 5005 respectively.

The TR*ip*2 unit will only accept RTP and RTCP packets from the same transport address (IP address and port number) as it is transmitting to. In this way, unauthorised access to transmitter resources is prevented.

The provision of a guaranteed quality of service for the audio data path is a feature of the IP network across which the data stream travels. In order to support QoS features within the network, the TR*ip*2 supports setting the Type of Service (ToS) in the IP packets used for the RTP audio stream.

Physical & Electrical

The analogue audio interface is provided on an RJ45 socket that shares functionality with the remote RS-232 port and Push To Talk (PTT) control pin. The pin connections are as shown in Table 3. The *Line In* and *Line Out* directions are as viewed by the TR*ip*2 unit.

Pin Number	Purpose
1	RS-232 RXD
2	RS-232 TXD
3	Audio Line Out
4	Audio Line In
5	Audio Line In
6	Audio Line Out
7	PTT I/O
8	Ground

Table 3: RJ45 Connections

The audio connection to the TR*ip*2 is a four-wire balanced 600 Ω circuit with input and output levels set on factory test to be -10 dBm. The audio levels are mapped directly between master and slave TR*ip*2 units, and a level of -20 dBm into the master will produce -20 dBm at the slave output.

There is an internal limiter within the TR*ip*2 unit which is set to 0 dBm when the unit leaves the factory. All audio levels above this value will be reduced and will produce 0 dBm at the corresponding TR*ip*2 output.

The electrical characteristics of the remote RS-232 port are specified in the next section.

The PTT I/O pin is a Push To Talk control pin whose function is dependent on which end of the link a particular unit is located. The functionality and electrical characteristics of this pin are specified in section 4.4.4.

4.4.2. Remote RS-232 Port

Functional

Each TR*ip*2 unit provides a remote terminal server capability through its remote RS-232 port. The connection between two units will be on a point-to-point basis only, mimicking the connectivity that would be provided by a dedicated copper connection.

General

For the pins related to the remote RS-232 connection, see Table 3: RJ45 Connections. All data received by a unit on the RXD pin will be transmitted over TCP and transmitted out on the TXD pin of the corresponding TR*ip*2/TR*ip* unit.

The unit will perform **no** interpretation of the data stream received on the local RXD pin, nor will it perform any interpretation of the data stream received from the remote unit for transmission on the local TXD pin. The unit will perform **no** character translation or echo. Any echo-back requirements must be performed by the attached terminal application.

Settings

Note that the settings for the remote serial port apply to the settings for both transmitting and receiving data.

The available settings for the remote RS-232 port are shown in Table 4:

Parameter (Units)	Available Settings	Default
Speed (kbps)	9600	9600
	19200	
	38400	
	57600	
	115200	
Data Bits	7, 8	8
Parity Bit	None, Even, Odd	None
Stop Bits	1, 2	1

Table 4: Remote RS-232 Port Settings

The TR*ip*2 does **not** support auto-detection of RS-232 port settings.

The TR*ip*2 does **not** provide hardware-based serial data flow control.

The use of software flow-control mechanisms (XON/XOFF) by higher layer applications is possible because of the transparent nature of the data streams, but support is **not** provided within the unit for this form of flow control.

Unlike the original TR*ip* unit, the RS-232 settings for the local and remote units do not need to be the same. However, it is recommended that the speeds of two units are the same.

IP Protocol Support

On startup, a master unit will attempt to establish a TCP connection with the remote (slave) unit with either the main or backup IP address and port number specified in the *unit* and *remote* module command-line parameters respectively. A slave unit will only accept a TCP connection from the main or backup IP address and port number.

The choice of which IP address/port number to use is determined by the setting of the *unit remote* (main/backup) command-line parameter, or by the current state of the main/backup unit input pin, if this has been configured.

If the TCP session cannot be established for whatever reason, a master unit will continue to attempt to establish a TCP connection.

The default port number for the TCP connection is 5008, but can be changed to any valid TCP port number in the range 2048 to 65535.

The RS-232 TCP link uses TCP keepalive to ensure that a long-standing connection is maintained between the two TR*ip* units, even when no data is being sent. The keepalive settings are configurable, but the default is to send keepalive probes every 60 seconds, and to consider the link broken when 10 consecutive probes fail to be acknowledged.

Physical & Electrical

The remote RS-232 port is supported using two dedicated pins, as shown in Table 3: RJ45 Connections.

The electrical characteristics of the remote serial port comply with the EIA/TIA-232-F standard, and are also compatible with the EIA RS-232D standard.

The remote RS-232 and local RS-232 configuration port share the same asynchronous UART device, but have separate RS-232 driver devices and physical ports.

Unlike the original TR*ip*, the local and remote RS-232 ports on the TR*ip*2 may be used at the same time without interference.

4.4.3.   Local RS-232 Port ("Prog" port)

Functional

The local RS-232 configuration port is used to facilitate the inspection and change of parameters from a locally connected RS-232 terminal, such as a personal computer, by providing access to the command-line interface described in section 4.6.

The local RS-232 port has the following settings, which cannot be changed:

Setting	Value (fixed)
Speed (kbps)	115200
Data Bits	8
Parity Bit	None
Stop Bits	1

Table 5: Local RS-232 Port Settings

Physical & Electrical

The local RS-232 port is supported using an RJ11 connector supporting five circuits as shown in Table 6. This table also shows the connections for a suitable serial cable terminating in a 9-way female D-type suitable for connection to a standard PC serial port.

RJ11 Pin Number	9-Way Female D-Type Pin Number	Function
6	No Connect	Not Used
5	2	RXD
4	8	CTS
3	3	TXD
2	7	RTS
1	5	GND

Table 6: Local RS-232 Port Pin Assignments

The electrical characteristics of the remote serial port comply with the EIA/TIA-232-F standard, and are also compatible with the EIA RS-232D standard.

Unlike the original TR*ip*, the local and remote RS-232 ports on the TR*ip*2 may be used at the same time without interference.

4.4.4. Logic Control Port

The TR*ip*2 also provides a logic control port that can provide remote monitoring and control of input/output pins on a TR*ip*/TR*ip*2 unit at the remote end of a logical link. Each local TR*ip*2 will periodically examine the state of its input pins and send updates on its current status to the remote TR*ip*/TR*ip*2 unit.

These updates are sent whenever a change on a pin is detected, and also periodically to maintain the state of the corresponding output pins. If a periodic update is not received on the remote TR*ip*/TR*ip*2 unit within a configurable time limit, the output pins will a default setting.

The failure of a TR*ip*2 to receive a logic control packet (LCP) update within a configured time will trigger the local/remote LCP alarm.

Pin changes are detected by polling the logic pins at a rate of 50 Hz (i.e. the pins are polled every 20 ms).

The periodic LCP update timeout is configurable between 3 and 30 seconds, and the periodic LCP update period is configurable between 1 and 10 seconds.

The logic control port provides a total of 9 pins that can each be configured as input or output pins. Pins 1 – 8 are general purpose input/output pins, and pin 9 is assigned as a PTT pin.

Any of the eight general purpose pins can be used to control the selection of main/backup slave unit. This functionality is only available when the relevant pin is configured as an input. When low, the pin selects the remote unit specified by the *unit set remote* command (see section 4.6 below). When high, the other unit selected.

All of the logic pins (including the PTT pin) can be configured to send an email when toggled either high/low. The messages to be sent are configured and are sent to the server selected within the SMTP module (see section 4.6). Emails are only sent when a pin is set as input and there is a message to be sent.

It is the responsibility of the installer to ensure that input pins at the local TR*ip*2 correspond to output pins at the remote TR*ip*/TR*ip*2, and vice versa.

By default, a newly shipped unit is a slave, and so the logic pin settings are as in Table 7.

When configured as an output, a pin can be set to have one of three default states, which are used when a logic control packet has not been received within the timeout period, as specified with the *logic set timeout* command. The three default states are:

- ON   The output pin will go on when a timeout occurs
- OFF   The output pin will go off when a timeout occurs

- NOC   No change – the state of the output pin will not be changed if a timeout occurs

To help ease configuration issues arising from these requirements, each TR*ip*2 can be set up to use one of two preconfigured setup profiles – "Master" or "Slave". The logic settings for master and slave logic profiles are shown in Table 7.

Parameter	Profile			
	Master		Slave	
	Value	Fail State	Value	Fail State
Pin 1	Output	Off	Input	-
Pin 2	Output	Off	Input	-
Pin 3	Output	Off	Input	-
Pin 4	Output	Off	Input	-
Pin 5	Input	-	Output	Off
Pin 6	Input	-	Output	Off
Pin 7	Input	-	Output	Off
Pin 8	Input	-	Output	Off
Pin 9 (PTT)	Input	-	Output	Off
Update Period	1 s	-	1 s	-
Update Timeout	6 s	-	6 s	-

Table 7: Default Profile Settings for Logic Pins

Physical & Electrical

Eight of the nine input/output pins are located on a dedicated 9-way female D-type connector, while pin 9 is provided as a push-to-talk control pin on the audio interface RJ45 port, as shown in Table 8.

Physical Connector	Physical Pin Number	Function
Logic I/O (9-Way Female D-type)	1	Logical Pin 1
	2	Logical Pin 2
	3	Logical Pin 3
	4	Logical Pin 4
	5	Logical Pin 5
	6	Logical Pin 6
	7	Logical Pin 7
	8	Logical Pin 8
	9	Ground
Line + 232 (RJ45)	7	Logical Pin 9 (PTT)

Table 8: Logical Pins

4.4.5. 10/100 Mbps Ethernet Port

The Ethernet port operates with auto-negotiation to allow configuration of the port for speed and duplex operation.

The pin assignments on the RJ45 network connector used are shown in Table 9.

Pin Number	Function
1	Transmit +
2	Transmit -
3	Receive +
4	Not Used

5	Not Used
6	Receive -
7	Not Used
8	Not Used

Table 9: Ethernet Port Pin Assignments

The Ethernet port has two LED indicators:

- Link Active Indicator – a yellow LED illuminated when a link up status is detected on the Ethernet port
- Data Present Indicator – a green LED illuminated on reception or transmission of packets on the Ethernet port

4.4.6. MAC Address

Each Ethernet port requires a globally unique MAC (Media Access Controller) address.

Programming of the MAC address into the unit will be done prior to production testing at manufacturing time.

4.5. Unit Configuration & Management

From version 2.3.5, the TR*ip* provides a web-based configuration interface that can be accessed by pointing your browser to the IP address of the TR*ip* unit. This interface mirrors all the functionality of the command-line interface and displays the settings of the TR*ip* unit in each of the sections that can be configured by clicking on the relevant section on the menu on the left-hand side of the web page. Settings can then be adjusted within each area and committed to the TR*ip* unit by clicking the SUBMIT button. This manual is available from the HELP section and a brief description of each of the TR*ip*'s settings can be obtained by hovering over the relevant item.

The TR*ip*2 also provides a command-line interface to configure the unit, either over the network using Secure Shell (SSH) or through the local RS232 port. The command-line interface is described in section 4.6.

A graphical tool, *TRipConfig 2*, is also available from the AWCSL website for configuring both TR*ip*2 and original TR*ip* units[2]. The command-line interface **must** be used when either configuring a TR*ip*2 unit through the local serial port or when updating the unit, but otherwise *TRipConfig 2* gives access to all the settings available through the command-line. *TRipConfig 2* is available from the software section of the AWCSL website, at http://www.awcsl.co.uk/technical/software.html.

For backwards compatibility with the original TR*ip*, A TELNET interface is also provided. We advise using SSH instead; the TELNET protocol provides no encryption, and so transmits all data (including usernames and passwords) in plain text format over the network, whereas SSH encrypts all data.

Getting SSH

To access a TR*ip*2 unit using SSH, you will need a SSH client. PuTTY, a free SSH client for Microsoft Windows, is available from the following links:

- http://www.chiark.greenend.org.uk/~sgtatham/putty/download.html, the download page,

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[2] Note that the older *TRip Config* program will **not** work with TR*ip*2 units.

- http://the.earth.li/~sgtatham/putty/latest/x86/putty.exe, the latest version of the PuTTY program for Windows.

To use PuTTY, simply download putty.exe from the above link and double-click the icon.

Accessing a TRip2 unit using PuTTY
1) Run PuTTY.
2) In the *Host Name (or IP address)* field, enter the IP address of the TR*ip*2 unit.
3) Select SSH as the *Connection Type*.
4) Click *Open*.

At this stage, a "PuTTY Security Alert" will appear stating that the server's host key is not cached in the registry. This is normal the first time you connect to a TR*ip*2 unit at a particular IP address – click *yes* to add the unit's key to the local registry.

4.6. Operating Firmware Upgrade

The operating firmware can be upgraded using the command-line interface **only** (i.e. not with the graphical *TRipConfig 2* program). The TR*ip*2 can be set to retrieve upgrades from any HTTP, FTP or TFTP server accessible over the network. Updates are available from the AWCSL downloads page over HTTP. The relevant settings for the update parameters (see section 5.6.10) to update over the internet are:

- Update protocol: http
- Update server: aw-comms.com
- Update file: downloads/trip2-updates/update-*x.y.z*.tar.bz2

Where *x*, *y* and *z* are the relevant version numbers.

For example, to set the parameters for updating a unit, a command-line session will look like (with typed-in commands in bold):

```
[TRip2]>> unit set update protocol http
(...)

[TRip2]>> unit set update server aw-comms.com
(...)

[TRip2]>> unit set update file downloads/trip2-updates/update-
x.y.z.tar.bz2
Update Protocol:   http
Update Server:     aw-comms.com
Update File:       downloads/trip2-updates/update-x.y.z.tar.bz2

[Trip2]>> unit update now
trip2-updater: Starting

(...)

Restarting software...
```

The update procedure will continue even if the telnet/SSH session with the unit is terminated. In this case the unit can be logged into later and the version number checked to see if the update was

successful. While the update is happening, anyone logging into the TR*ip*2 unit can see the update progress message as they are printed by issuing the command "unit update notify".

When the update is complete, the unit's firmware will be restarted, including the configuration program, and the telnet/SSH session with the unit will end. At this point, the new firmware will be running, and logging into the TRip2 and checking the version number will confirm this. From TR*ip*2 version 2.2.0 onwards, there is no longer any need to reboot the unit after it has been updated.

If access to the internet is not available, the update file can be downloaded to a local server for local downloading. In this case, note that both the update file *and* the accompanying .md5 file must be downloaded, and the .md5 file must be made available in the same directory as the update file.

Note that the %h, %i and %m macros available in the original TR*ip* are deprecated, and not used in the TR*ip*2.

4.7. Configuration Access Security

Access to the local or remote command-line interface (see section 4.8) is controlled using a configurable access name and access password combination.

Each time a new SSH/telnet session is connected to the unit, the access name and password must be entered prior to any configuration commands.

When the units leave the factory the access name is set to "default" and no password is required.

4.8. Alarms

The TR*ip*2 will maintain a number of internal alarm status variables. These variables will be set or unset based upon operating conditions encountered by the unit. Each alarm variable (except for the LAN alarm) will have an associated local and remote delay parameter. These delays will be used to minimise false alarm signalling to local or remotely based alarm monitoring systems. If an alarm status variable is unset during the delay period, no alarm condition is signalled. A delay setting of 0 disables the alarm.

Each local alarm status variable can be used to control the local alarm LED indicator, and each remote alarm status variable can be used to trigger transmission of an SMTP email.

4.8.1. LAN Link Status Alarm

The LAN link status alarm is used to indicate that the LAN connection has failed and the unit can no longer send data to the network. For obvious reasons, this alarm condition can only be signalled locally, but any corresponding remote unit will generate an RTP and/or LP alarm to its remote monitoring host.

4.8.2. RTP Audio Activity Alarm

Even when there is no audio to pass across the link, the units will be exchanging periodic silence insertion descriptor packets. The failure to receive any RTP packets within a period will be signalled as an alarm condition, as it may result in the failure of audio transfer when required.

4.8.3. RTCP Audio Issues Alarm

The RTCP audio issues alarm will be activated if one or more of the statistics provided by RTCP exceeds given parameters. For example, an increase in the average packet loss may result in poor quality audio.

The statistics are calculated on information passed back from the peer, so if the IP connection to the remote unit is broken then these statistics will not be generated until the connection is re-established.

4.8.4. LCP Missing Updates Alarm

An LCP (logic control packet) alarm will be activated if no logic packets are received in a given period of time. LCPs are generated when either a change in a logic input value is detected, or when the update time has expired.

4.8.5. RS232 Alarm

An RS232 alarm will be activated if no RS232 TCP link is active in a given period of time. The TR*ip*2 unit uses TCP keepalive to monitor the status of this link, so even long-standing connections with no data being passed across them will generate an alarm if the two units cannot communicate with each other for long enough.

4.8.6. Alarms Summary and Defaults

Alarm Status Variable	Local		Remote	
	Delay Range (seconds)	Delay Default	Delay Range (seconds)	Delay Default
LAN Link Status	1 – 3600	1	-	-
RTP Audio Activity	5 – 3600	5	5 – 86400	60
RTCP Audio Issue	5 – 3600	5	5 – 86400	0
LCP Missing Updates	5 – 3600	5	5 – 86400	60
RS232 TCP Link	5 – 3600	5	5 – 86400	60

Table 10: Alarm Status Variables

4.8.7. Alarm Notification Using the Logic Control Port

Any pin except pin 9 (PTT) of the logic control port can be configured as an alarm indicator output. In this scenario the pin will not reflect the status of the corresponding pin on the remote TR*ip*/TR*ip*2 unit, but will instead be used to indicate that an internal alarm status has been triggered.

4.8.8. Alarm Notification Using Email

The TR*ip*2 also includes an SMTP client for the purpose of transmitting alarm status messages via email.

Most parameters of the email message are configurable to allow maximum flexibility, but the subject and message body of an email sent when an alarm set will be:

```
Subject: [Unit Name] Trip2 [Alarm Name] alarm set
Body: [Unit Name] The [Alarm Name] has been set on this Trip2 unit
```

Where *[Unit Name]* will be replaced with the unit's configured name (with the *unit set name* command) and *[Alarm Name]* is the name of the alarm – either RTP, RTCP or LCP.

The subject and message body of an email sent when an alarm is cleared will be:

```
Subject: [Unit Name] Trip2 [Alarm Name] alarm cleared
Body: [Unit Name] The [Alarm Name] has been cleared on this Trip2 unit
```

The use of a suitable email-to-SMS gateway application will allow the signalling of alarm conditions to mobile telephones via SMS messages.

4.9.   Patching

Note: Patching functionality is only available for TRip2 version 1.0.27 and later. Please follow the TRip2 update procedure if you need to upgrade to a newer version.

The TR*ip*2 can be configured to use a *patching mode*, which allows two radio sites to enable/disable talkthrough. This can be triggered by the value of a logic pin or in response to a selcall message at either site, and patching activation/deactivation can be monitored via a generated selcall message or a logic output.

When patching is activated, logic packets (containing, for example, COR and PTT logic levels) will be passed between the TR*ip*2 units as usual, allowing one site's COR to trigger the other site's PTT and vice-versa. When patching is deactivated, logic packets will still be sent as a "keep-alive" measure, but logic levels will be ignored, meaning a COR at one site no longer triggers PTT at the other.

Although selcall and logic pin monitoring/responses can be used together, the following two sections describe them independently.

4.9.1.   Patching Using Selcall

For patching to be triggered via selcall messages, an "on" and "off" selcall message must be set on both TR*ip*2 units, and this must be the same for each unit. When the TR*ip*2 units see the selcall "on" message, patching will be activated. It will then be deactivated when the selcall "off" message is received. Additionally, a timeout of between 5 and 500 seconds can be set, after which patching will be deactivated.

The TR*ip*2 units can also be configured to generate selcall strings when patching is activated or deactivated. The patching deactivated selcall string will be sent whether patching mode has been deactivated by an incoming "off" message or a timeout.

4.9.2.   Patching Using the Logic Port

For patching activated using the logic port, an input pin must be assigned as the patching control pin. Patching will be activated when this pin is on and deactivated when it is off. No timeout will occur if patching is activated via the logic control pin.

A logic pin can also be used as a patching output pin, which will be on when patching is activated and off when it is deactivated.

Note: Patching will not work correctly using the logic port unless (i) both TRip2 units have the same logic pin configured as a patching control pin and (ii) both TRip2 units have that pin configured as a logic input pin.

4.9.3.   Patching Using Both Selcall and the Logic Port

Patching can be configured using both selcall messages and logic port input, and to provide notification of the patching state using either method. For example, the TR*ip*2 can be configured to generate selcall acknowledgement messages when the patching is activated via a logic pin, or to toggle an output pin when patching is activated via a selcall message.

Note that if a TR*ip*2 unit is configured so that either a selcall message or a logic pin can toggle patching, the unit will only timeout if patching is activated by a selcall message and patching will only become deactivated when both modes indicate that patching should be deactivated.

4.10. VOX Detection

Note: VOX functionality is only available for TRip2 version 1.0.37 and later. Please follow the TRip2 update procedure if you need to upgrade to a newer version.

The TR*ip*2 can be configured to trigger a logic pin on VOX detection. This is typically done in order to trigger COR from a slave TR*ip*2 at a base station that does not have its own COR generator. The following settings control the behaviour of the TR*ip*2's VOX detection:

Setting	Range	Default Value
Trigger Level	-60 dBm – 0 dBm	-17 dBm
Hang Time	0 – 10 seconds	2 seconds
Logic Pin	0 – 9	0

Table 11: VOX Settings and Defaults

The VOX trigger level defines the level that must be seen on the local audio device (e.g. a connected DRC-1s or similar) to trigger VOX, with 0 dBm indicating no VOX value (since the TR*ip*2 audio is limited at 0 dBm, VOX would never be triggered if this literally meant a 0 dBm level). The hang time defines how long after the TR*ip*2 unit stops seeing this level that the VOX is disabled. The logic pin defines the logic pin on the outgoing logic stream used to indicate VOX – this must be a logic output pin on the remote trip. Use pin 9 if you want VOX to trigger PTT on the remote TR*ip*2 unit, and pin 1 is usually used if you want VOX to indicate COR (e.g. on a TRICX or DRC*ip*).

In order to enable VOX detection, all three of the above parameters must be set to non-zero values.

4.11. Time Synchronisation

The TR*ip*2 will attempt to set its local clock time using the network time protocol (NTP) every time it boots, as well as every hour. Up to three NTP servers can be configured using the command-line interface (see section 5 below).

Note that the TR*ip*2 does **not** require the correct time to be set – this is purely for using the syslogging function. If no NTP servers are available, the TR*ip*2 will set the current time to be midnight on January 1st, 1970 at start-up. You can find out what time a TR*ip*2 unit currently holds using the *unit show time* command-line function.

There are many publicly available NTP servers available on the internet – an incomplete list can be found at www.ntp.org. The default NTP servers are pool.ntp.org and ntp.ubuntu.com. If the TR*ip*2 unit is installed on a private LAN with no internet connection then a local NTP server can be setup in order to provide a clock source.

4.12. External Power

External regulated +12 V DC power is provided to the TR*ip*2 by means of a 2.1 mm centre-positive jack socket. Power for this is provided by an external switched-mode power supply.

A green LED indicator is provided that is directly powered from the internally generated 3.3 V power supply. Absence of the external +12 V or failure of the internal power supply will be indicated by this LED **not** being illuminated.

4.13. Physical Format & Enclosure

The TR*ip*2 is usually a standalone unit designed to be either wall or desktop mounted, and provided with an external regulated plug top style mains power supply. The TR*ip*2 unit is mounted in an aluminium extrusion measuring 115 mm (width) by 34 mm (height) by 125 mm (depth).

The rear panel holds the power connector and the LAN connector whilst the front panel holds the line/remote port, the logic I/O port and the configuration port.

The mechanical design of the PCB will also allow multiple cards to be mounted in a rack-mount unit.

The physical format of the TR*ip*2 is designed to be as close to the original TR*ip* unit as possible. As standalone units the two are identical, and the TR*ip*2 PCB can be mounted wherever a TR*ip* unit can be.

4.14. LED Indicators (Summary)

The TR*ip*2 has the following LED indicators:

LED Name	Colour	Function
Power	Green	Indicates the presence of the internal +3.3 V power supply
LAN Link	Yellow	Indicates the status of the Ethernet connection. *On* indicates link up status.
LAN Data	Green	Indicates the reception or transmission of data on the Ethernet port.
Alarm	Red	Indicates an alarm has been triggered on the unit.

Table 12: LED Indicators

5.   Command-Line Interface

Note: Although the TRip2 provides a command-line interface, a more user-friendly interface is provided by the TRip2 Config program, available at:

http://www.awcsl.co.uk/technical/software.html

The TR*ip*2 unit provides a command-line interface (CLI) for inspection and configuration of the unit's settings. The CLI can be accessed through either the local RS-232 port (see section 4.4.3) or remotely using SSH/TELNET (see section 4.5).

5.1.   Username and Password

A valid username and password must be provided in order to access the CLI, in order to prevent unauthorised access to the TR*ip*2 settings.

The default username is *"default"*, and there is no default password (i.e. leave any password field blank).

5.2.   Command Syntax

After logging into a TR*ip*2 unit, the CLI will provide a prompt as shown below:

```
[UNIT IDENTIFIER]>>
```

The unit identifier is a configuration option that provides a user-configurable name up to a maximum of 15 characters that can be used to identify the unit. By default the unit identifier is *"Slave"*.

The command syntax consists of three parts – a module name, an action verb and a variable set of action parameters. Each command is terminated by a carriage return:

```
[Module Name] <Action Verb> <Parameter List> [CR]
```

Although each module name or action verb may consist of several letters, only sufficient letters to uniquely identify the module name or action verb are required. For example to enter the name **LOCAL**, only three characters **LOC** are required to differentiate it from the module named **LOGIC**.

The entry of an incomplete command (or just the command **help**) will invoke the help text specific to that incomplete command

5.3.   Special Commands

The following special commands can be entered directly at the command-prompt:

Command	Action
help	Show the modules available from the top-level menu
exit	End this command-line interface session
__reset_all_748	Resets the TR*ip*2 unit to its factory configuration (with certain exceptions – see below). See section 5.4 for details before you do this.

Table 13: CLI Special Commands

5.4.   Restoring a Unit's Factory Settings

The special (and hidden) command *"__reset_all_748"* can be used at the command-line prompt in order to restore a TR*ip*2 unit to use most of its default factory settings. This command does not take advantage of unique completion – it must be typed in its entirety.

The following settings that are not affected by this command:

1.   The settings in the *Access* module (access name and password).
2.   The settings in the *IP* module (IP address, netmask, gateway and DNS server).

You do not need to restart the unit after this command for the default settings to take effect.

5.5.   Command History & Line Editing

The TR*ip*2 offers both command history and line editing features not found in the original TR*ip*. Simply use the up and down keys to scroll back through previous commands, and the left and right keys to move the cursor on the current line. Previous commands can be edited and entered again.

5.6.   Modules

The CLI supports the following configuration module names:

Module Name	Module Description
ACCESS	This module allows configuration of the user access name and password
ALARMS	This module allows the configuration of the alarm control parameters
AUDIO	This module allows the configuration of the analogue front-end parameters and the treatment of the audio streams
IP	This module permits the configuration of the IP parameters specific to this unit
LOGIC	This module accesses the configuration and settings of the logic control port
PATCHING	This module accesses the patching settings
REMOTE	This module defines the configuration and settings of the remote asynchronous configuration port
RTP	This module allows the configuration of the RTP and RTCP protocols for the unit
SMTP	This module permits the configurations and settings for the SMTP client
UNIT	This module looks after various other miscellaneous functions and configuration options for the unit

Table 14: Command-Line Module Names and Descriptions

5.6.1.   Access Module Action Verbs

Action Verb	Parameters		Comment
	1	2	
SET	NAME	<username>	This module allows configuration of the user access name to be *username*. *username* can be up to 30 characters long, and can contain any printable character
	PASSWORD		Brings up a prompt to confirm the current password (if set) and to set a new password, which must be repeated
SHOW	ALL		Shows the current access name only (there is no way to show the current password)

Table 15: Access Module Configuration Commands

5.6.2. Alarms Module Action Verbs

Action Verb	Parameters			Comment
	1	2	3	
SET	LAN	LOCAL	<delay>	Sets the local alarm generation delay for the LAN link loss alarm to be *delay* seconds, where *delay* is in the range from 1-3600. A value of 0 disables the generation of this alarm.
	RTP	LOCAL	<delay>	Sets the local alarm generation delay for the loss of incoming RTP packets alarm to be x seconds where x is in the range 5 –3600 seconds. A value of 0 disables the generation of the alarm
		REMOTE	<delay>	Sets the remote alarm generation delay for the RTP packet stream loss alarm to be x seconds where x is in the range 5 – 86,400 seconds. A value of 0 will disable the alarm generation
	RTCP	LOCAL	<delay>	Sets the local alarm generation delay for the RTCP statistics alarm to be x seconds where x is in the range 5 –3600 seconds. A value of 0 disables the generation of the alarm
		REMOTE	<delay>	Sets the remote alarm generation delay for the RTCP statistics alarm to be x seconds where x is in the range 5 – 86,400 seconds. A value of 0 will disable the alarm generation
		JITTER	<value>	Sets the average jitter value in milliseconds that must be exceeded in order to generate the RTCP alarm
		DELAY	<value>	Sets the average Delay value in milliseconds that must be exceeded in order to generate the RTCP alarm *(This setting is not available in the first release)*
		LOSS	<value>	Sets the average packet loss value that must be exceeded in order to generate the RTCP alarm
		PERIOD	<time>	Sets the period in seconds over, which the received RTCP statistics are calculated. The values can range between 60 – 3600 seconds
	LCP	LOCAL	<delay>	Sets the local alarm generation delay for the LCP packet loss alarm to be x seconds where x is in the range 5 –3600 seconds. A value of 0 disables the generation of the alarm
		REMOTE	<delay>	Sets the remote alarm generation delay for the LCP packet loss alarm to be x seconds where x is in the range 5 – 86,400 seconds. A value of 0 will disable the alarm generation
CLEAR	ALL			Resets the alarm status to pending of all outstanding alarms. All delay counters are reset. No SMTP messages or SNMP traps will be generated
	LAN			Resets the alarm status to pending for the LAN alarm. The delay counter is reset. No SMTP message or SNMP trap will be generated

	RTP			Resets the alarm status to pending for the RTP alarm. The delay counter is reset. No SMTP message or SNMP trap will be generated
	RTCP			Resets the alarm status to pending for the RTCP alarm. The delay counter is reset. No SMTP message or SNMP trap will be generated
	LCP			Resets the alarm status to pending for the LCP alarm. The delay counter is reset. No SMTP message or SNMP trap will be generated
SHOW	ALL			Lists the current alarms that are pending and then set along with the how long ago they were set.
	SETTINGS			Lists the current settings for the alarm delays, and also the Pin number for an LCP pin used as a Local Alarm Condition indicator
	HISTORY			List the last 10 alarm generation and clearance events with a time differential from the current system time in minutes and hours

Table 16: Alarms Module Configuration Commands

5.6.3. Audio Module Action Verbs

Action Verb	Parameters			Comment
	1	2	3	
SET	DATARATE	64		Sets the data rate for the audio codec to be 64 kbps (G.711 A-law compression)
		40		Sets the data rate for the audio codec to be 40 kbps (G.726 compression)
		32		Sets the data rate for the audio codec to be 32 kbps (G.726 compression)
		24		Sets the data rate for the audio codec to be 24 kbps (G.726 compression)
		16		Sets the data rate for the audio codec to be 16 kbps (G.726 compression)
		8		Sets the data rate for the audio codec to be 8 kbps (Speex compression)
	SAMPLE	<period>		Sets the period between each transmitted RTP audio packet to be *period* milliseconds, with *period* between 5 and 30
	MICROPHONE	<level>		Sets the microphone to be adjusted by *level* dB on input. *level* can be any number between 0.0 and +22.5 dB, and will be rounded to the nearest 1.5 dB.
	SPEAKER	<level>		Sets the speaker to be adjusted by *level* dB on output. *level* can be any number between -40.0 and 0.0 dB, and will be rounded to the nearest 0.5 dB.
	VOX	LEVEL	<level>	Sets the VOX to be triggered when the TR*ip*2 sees audio above this level, in percent of total audio range.
		HANG	<time>	Time after seeing the VOX level to disengage VOX.
SHOW	ALL			Lists all the configuration settings for the audio module

Table 17: Audio Module Configuration Commands

5.6.4. IP Module Action Verbs

Note: These settings will only take effect after the unit has been rebooted, e.g. with the command "unit reboot now".

Action Verb	Parameters		Comment
	1	2	
SET	ADDRESS	<address>	Sets the unit's IP address to be *address* on the next reboot
	MASK	<mask>	Sets the unit's subnet mask to be *mask* on the next reboot
	GATEWAY	<address>	Sets the IP address of the default gateway for this unit to be *address* on the next reboot
	DNS	<address>	Sets the IP address of the default DNS server to be *address* on the next reboot
SHOW	ALL		Lists all the configuration settings for the IP module
PING	<hostname>		Sends 10 ICMP ping packets to *hostname*

Table 18: IP Module Configuration Commands

5.6.5. Logic Module Action Verbs

Action Verb	Parameters			Comment
	1	2	3	
SET	MAIN	PORT	<port>	This command sets the Main IP port number of the remote unit to which Logic control packets will be sent and received to be XXX. The default value is 5006, but can be any value above 5000
	BACKUP	PORT	<port>	This command sets the Backup IP port number of the remote unit to which Logic control packets will be sent and received to be XXX. The default value is 5006 but can be any value above 5000
	IN	PIN	<pin>	Sets pin *pin* to be an Input where *pin* has a value between 1 and 9
	OUT	PIN	<pin>	Sets pin *pin* to be an Output where *pin* has a value between 1 and 9
	REMOTE	PIN	<pin>	This command selects pin *pin* as the toggle for switching between the main or backup remote unit. *pin* can have a value between 0 and 8. The value 0 disables this function. The default value is 0. This command will only succeed if the unit is currently defined as a Master unit, and the Pin is currently defined as an input. When configured as a toggle switch, the status of this pin sent to the remote units is always OFF.
	ALARM	PIN	<pin>	This command selects pin *pin* as an Alarm output Pin. *pin* can have a value between 0 and 8. The value 0 disables this function. The default value is 0. This command will only succeed if the Pin is currently defined as an output. When configured as an alarm output, the status of the corresponding remote pin is ignored.

	EMAIL	ON	<pin>	This command causes the pin *pin* to send an email when it is toggled.
		OFF		This command disables the sending of email when pin *pin* is toggled.
	ON	FAILSTATE	<pin>	Sets the no update messages fail state to be ON for pin *pin*. (Only Applicable when Pin *pin* is set be an output). *pin* is in range [1,9].
	OFF			Sets the no update message fail state to be OFF for pin *pin*. (Only Applicable when Pin X is set be an output). *pin* is in range [1,9].
	NOC			Sets the no update message fail state to be NOC (No Change) for pin *pin*. (Only Applicable when Pin *pin* is set be an output). *pin* is in range [1,9]
	POLLRATE	<rate>		Sets the Logic Port Poll rate to be *rate* times per second where *rate* can be between 1 and 10. Detecting a change will cause a Logic Update message to be sent immediately. (Default Value is 10)
	UPDATE	<time>		Sets the no change update time to be *rate* where *rate* is between 1 and 10 seconds. If no change is detected on the logic port in *rate* seconds a Logic update message is sent anyway. (Default Value is 2 seconds)
	TIMEOUT	<time>		Sets the no logic update message timeout to be *rate* seconds where *rate* is between 3 and 30 seconds. If no Logic Update Message is received within the timeout period, the Logic port is set to the pre-configured default value. (Default Value is 6 seconds)
	PROFILE	MASTER		Sets the Logic Port Parameters to be the following values: POLLRATE = 10 times / second UPDATE TIME = 1 seconds TIMEOUT = 30 seconds PIN 1 = OUTPUT, Fail state = OFF PIN 2 = OUTPUT, Fail state = OFF PIN 3 = OUTPUT, Fail state = OFF PIN 4 = OUTPUT, Fail state = OFF PIN 5 = INPUT PIN 6 = INPUT PIN 7 = INPUT PIN 8 = INPUT PIN 9 = INPUT

				Sets the Logic Port Parameters to be the Following Values:- POLLRATE = 10 times / second UPDATE TIME = 5 seconds TIMEOUT = 6 seconds PIN 1 = INPUT PIN 2 = INPUT PIN 3 = INPUT PIN 4 = INPUT PIN 5 = OUTPUT, Fail state = OFF PIN 6 = OUTPUT, Fail state = OFF PIN 7 = OUTPUT, Fail state = OFF PIN 8 = OUTPUT, Fail state = OFF PIN 9 = OUTPUT, Fail state = OFF
		SLAVE		
SHOW	ALL			Lists all the configuration settings for the logic module

Table 19: Logic Module Configuration Commands

5.6.6. Patching Module Action Verbs

Action Verb	Parameters			Comment
	1	2	3	
SET	MODE	ON		Use patching
		OFF		Don't use patching (the rest of the parameters are ignored)
	CONTROL	PIN	\<pin\>	Sets *pin* to be an input pin governing the patching state. When the pin goes on, patching is activated – when it goes off, patching is deactivated
	OUTPUT	PIN	\<pin\>	Sets *pin* to be an output pin showing the patching state. When patching is activated, this pin is on – when it is deactivated, this pin is off
	ON	MESSAGE	\<string\>	Set the selcall message that activates patching (leave *string* blank for none)
		ACKNOWLEDGE	\<string\>	Set the selcall message sent when patching is activated (leave *string* blank for none)
	OFF	MESSAGE	\<string\>	Set the selcall message that deactivates patching (leave *string* blank for none)
		ACKNOWLEDGE	\<string\>	Set the selcall message sent when patching is deactivated (leave *string* blank for none)
	TIMEOUT	\<time\>		Set the maximum time that patching can remain active for, in seconds. This only applies to patches activated by a selcall "on" message, and *time* must be in the range 5-500 (inclusive) or 0 for no timeout.
SHOW	ALL			Lists all the configuration settings for the patching module

Table 20: Remote Module Configuration Commands

5.6.7. Remote Module Action Verbs

Action Verb	Parameters			Comment
	1	2	3	
SET	DATA	8		Sets the number of data bits to be 8
		7		Sets the number of data bits to be 7
	STOP	1		Sets the number of stop bits to be 1
		2		Sets the number of stop bits to be 2
	PARITY	EVEN		Sets the parity bit to be even
		ODD		Sets the parity bit to be odd
		NONE		Don't use a parity bit
	SPEED	9600		Sets the port speed to be 9600 bps
		19200		Sets the port speed to be 19200 bps
		38400		Sets the port speed to be 38400 bps
		57600		Sets the port speed to be 57600 bps
		115200		Sets the port speed to be 115200 bps
	MAIN	PORT	<port>	This command sets the Main IP port number of the remote unit to which remote serial port packets will be sent to and received from to be *port*. The Default Value will be 5008, and must be in the range 2048 – 6555 (inclusive)
	BACKUP	PORT	<port>	This command sets the Backup IP port number of the remote unit to which RTP packets will be sent to and received from to be *port*. The Default Value will be 5008, and must be in the range 2048 – 6555 (inclusive)
	TOS	LOW DELAY		Use low delay ToS field
		THROUGHPUT		Use throughput ToS field
		RELIABILITY		Use reliability ToS field
		NONE		Use no ToS field
SHOW	ALL			Lists all the configuration settings for the remote module

Table 21: Remote Module Configuration Commands

5.6.8. RTP Module Action Verbs

Action Verb	Parameters			Comment
	1	2	3	
SET	MAIN	PORT	<port>	This command sets the Main IP port number of the remote unit to which RTP packets be sent to and received from to be XXXX. The Default Value will be 5004, and must always be even and above the value 5000. The port used for RTCP is always RTP+1. The default RTCP port is 5005.
	BACKUP	PORT	<port>	This command sets the Backup IP port number of the remote unit to which RTP packets will be sent to and received from to be XXX. The Default Value will be 5004, and must always be even, and above the value 5000. The port used for RTCP is always RTP+1. The default RTCP port is 5005.
	BUFFER	<time>		Set the RTP receive buffer, in milliseconds. Default is 100 ms, values between 50 and 500 ms are valid.
	TOS	LOW DELAY		Use low delay ToS field
		THROUGHPUT		Use throughput ToS field
		RELIABILITY		Use reliability ToS field
		NONE		Use no ToS field
SHOW	ALL			Lists all the configuration settings for the RTP module

Table 22: RTP Module Configuration Commands

5.6.9. SMTP Module Action Verbs

Action Verb	Parameters			Comment
	1	2	3	
SET	SERVER	1	<hostname>	Sets the hostname of primary SMTP server to be "hostname". E-mail will be sent on assertion of an alarm condition via the primary server if configured.
		2	<hostname>	Sets the hostname of secondary SMTP server to be "hostname". E-mail will be sent on assertion of an alarm condition via the secondary server if configured.
	TO	ADDRESS	<email>	Sets the To: address for emails to *email*.
	CC	ADDRESS	<email>	Sets the CC: address for emails to *email*.
	FROM	ADDRESS	<email>	Sets the From: address for emails to *email*.
	SUBJECT	<subject>		Sets the contents of the subject fields for emails to *subject*.
	PINHIGH	<pin>	<message>	Sets the email message to send when pin number *pin* goes high to *message*. *pin* is a pin number from 1 – 9 inclusive.
	PINLOW	<pin>	<message>	Sets the email message to send when pin number *pin* goes low to *message*. *pin* is a pin number from 1 – 9 inclusive.

Action Verb	Parameters			Comment
	TEST	<message>		Use the current SMTP settings to send an SMTP mail message with *message* as the message body, or a default message if this is not specified.
	SHOW	ALL		Lists all the configuration settings for the remote module.

Table 23: SMTP Module Configuration Commands

5.6.10. Unit Module Action Verbs

Action Verb	Parameters			Comment
	1	2	3	
SET	MAIN	ADDRESS	<address>	Sets the IP address for the Main remote unit linked to this unit. This IP address is used for the RTP over UDP connection, the Logic Port over TCP session and the Serial Port over UDP session.
	BACKUP	ADDRESS	<address>	Sets the IP address for the Backup remote unit linked to this unit
	NAME	<name>		Sets the unit name for this unit to be *name*, which can contain any alphanumeric characters. Maximum of 30 characters.
	REMOTE	MAIN		Sets the primary remote unit to communicate to as the unit defined by the MAIN IP address and Port values.
		BACKUP		Sets the primary remote unit to communicate to as the unit defined by the BACKUP IP address and Port values.
	UPDATE	PROTOCOL	HTTP	Retrieve updates using HTTP.
			FTP	Retrieve updates using FTP.
			TFTP	Retrieve updates using TFTP.
		SERVER	<hostname>	Sets the update server to *hostname*.
		FILE	<file>	The name of the update file to request from the update server.
	NTP	<num>	<hostname>	Set *hostname* as NTP server *num*, where *num* is 1 – 3 inclusive.
UPDATE				Retrieve updates using the parameters set using the *unit set update...* commands. These updates will **not** take effect until the unit is rebooted.
REBOOT				Reboot the unit immediately.
SYNCHRONISE				Synchronise the unit's time with the remote NTP servers.
SHOW	ALL			Lists all the configuration settings for the unit module.
	TIME			Show the current time, according to this unit's time settings.

Table 24: Unit Module Configuration Commands

6. TR*ip*/TR*ip*2 Differences and Compatibility

Although the TR*ip*2 is intended as a slot-in replacement to the original TR*ip* unit, the TR*ip*2 includes some changes and some improvements to the functionality of the TR*ip*, and they are briefly described in this section.

In general, the physical and functional aspects of the TR*ip*2 are identical to those of the original TR*ip*, except for the specific items described here.

6.1. Existing AWCSL TRICX Systems

The TR*ip*2 has been fully tested with the AWCSL TRICX system. It is compatible with all TRICX systems that use the G.711 codec (the default for TRICX systems) as a slot-in replacement to an original TR*ip*.

6.2. Audio Codecs

The original TR*ip* featured three audio codecs:

- G.711 A-law at 64 kbps (the default)
- G.729 at 8 kbps
- G.723 at 6.3 or 5.3 kbps

The only codec that's been kept in TR*ip*2 is the G.711 A-law codec. In order for an original TR*ip* and a TR*ip*2 unit to be able to pass audio between one another, they both have to be using this codec. For a full list of codecs supported by the TR*ip*2, see Table 1: Supported Audio Codecs.

Additionally, codecs in the TR*ip*2 may be asymmetric – unlike with the original TR*ip*, two TR*ip*2 units do **not** need to be configured to use the same data rate settings in order to communicate. The data rate a TR*ip*2 is set to (see section 5) determines the encoding of audio data sent *out* from that unit – any RTP packets received from the remote TR*ip*2 will be dynamically decoded based on their payload type (see Table 1: Supported Audio Codecs).

6.3. Remote Configuration

The TR*ip*2 uses the SSH (secure shell) protocol for remote configuration, so that usernames and passwords are encrypted when accessing a TR*ip*2 unit remotely – see section 4.5 for details of using SSH.

The TR*ip*2 retains support for accessing the unit via the unsecure TELNET protocol, if required.

The original TR*ip* Config program is **not** compatible with the TR*ip*2, but the TR*ip*2 Config program is backwards-compatible with the original TR*ip*.

6.4. Local and Remote RS-232 Ports

In the original TR*ip*, the local and remote RS-232 ports were mutually exclusive and could **not** both be used at the same time. This is not the case in the TR*ip*2 – both ports can be used without interference.

Unlike with the original TR*ip*, remote RS-232 port settings do **not** need to be the same in order for two TR*ip*2 units to communicate remotely, though we recommend the same baud rate is used.

6.5. Command-Line Interface

There have been some minor changes to the command-line interface (see section 5).

Additionally, the TR*ip*2 offers command history and line editing features not found in the original TR*ip* (see section 5.5) and the ability to reset the unit to its factory settings (see section 5.4).

6.6. Default Configuration

The default configuration of a new TR*ip*2 unit is the same as that of a new original TR*ip* unit, with the exception of the unit's IP address and its main and backup IP addresses.

- The IP address of a new TR*ip*2 unit is 192.168.1.74
- The unit main and backup IP address is 192.168.1.75

6.7. Patching

Patching support is a new addition to the TR*ip*2 – original TR*ip* units have no support for this.

7. Audio Codec Bandwidth

Table 25 shows the audio bandwidth required for different audio codecs at various sampling periods. Please note the following:

- All rates are in kilobits per second (1 kilobit = 1,000 bits).
- Audio is transmitted at all times, even when transmitting only silence.
- These rates include all data needed for audio transfer, including the UDP, IP and Ethernet headers.
- Quoted rates to **not** include any bandwidth needed for logic and/or RS-232 data transfer. The bandwidth needed for these varies depending on their usage, although they are typically only a small fraction of any audio bandwidth used.

Codec	Data Rate (kbits/s)	Sample Period (ms)	Total Bandwidth (kbits/s)
G711	64	10	107.2
	64	20	85.6
G726	40	10	83.2
	40	20	61.6
	32	10	75.2
	32	20	53.6
	24	10	67.2
	24	20	45.6
	16	10	59.2
	16	20	37.6
Speex	8	20	29.6

Table 25: Bandwidth Needed for Different Audio Codecs

8.   Document Changes

Version	Date	Notes
1.1	8th June 2010	Added TR*ip*/TR*ip*2 differences and information about the Speex codec. Added information about "audio microphone" and "audio speaker" commands.
1.2	21st February 2010	Added information about the new patching facility, as well as information on using the TR*ip*2 with NAT.
1.5	12th March 1012	Added information on audio patching/VOX detect and RTP receive buffer.

9.   Using TRip2 Units with Routers on a Wide-Area Network

Figure 3 shows a minimal example of two TR*ip*2 units configured to talk over a wide-area network (WAN). This scheme uses network address translation (NAT) to correctly route data from one TR*ip*2 unit to another. Important points to note are:

- Each TR*ip*2 unit has its main address set to the external IP address of the router on the *other* network, and has its gateway address set to the internal IP address of the router on its *own* network.
- Each router is set up to forward ports 5004-5008 to the IP address of the TR*ip*2 unit on its *own* network. The only ports that need to be forwarded are:
    o RTP and RTCP (defaults 5004 & 5005), which are UDP ports,
    o Logic (default 5006) which is a UDP port, and
    o RS-232/remote (default 5008) which is a TCP port.

Wide-Area
Network

(108.167.25.212)

Router
Forward ports 5004-5008 to
192.168.1.70

(192.168.1.1)

PC's, devices,
etc.

TR*ip*2 (192.168.1.70)
Gateway: 192.168.1.1
Main IP: 217.43.28.105
RTP Port: 5004
Logic Port: 5006
Remote (RS232) Port: 5008

(217.43.28.105)

Router
Forward ports 5004-5008 to
10.0.0.90

(10.0.0.1)

PC's, devices,
etc.

TR*ip*2 (10.0.0.90)
Gateway: 10.0.0.1
Main IP: 108.167.25.212
RTP Port: 5004
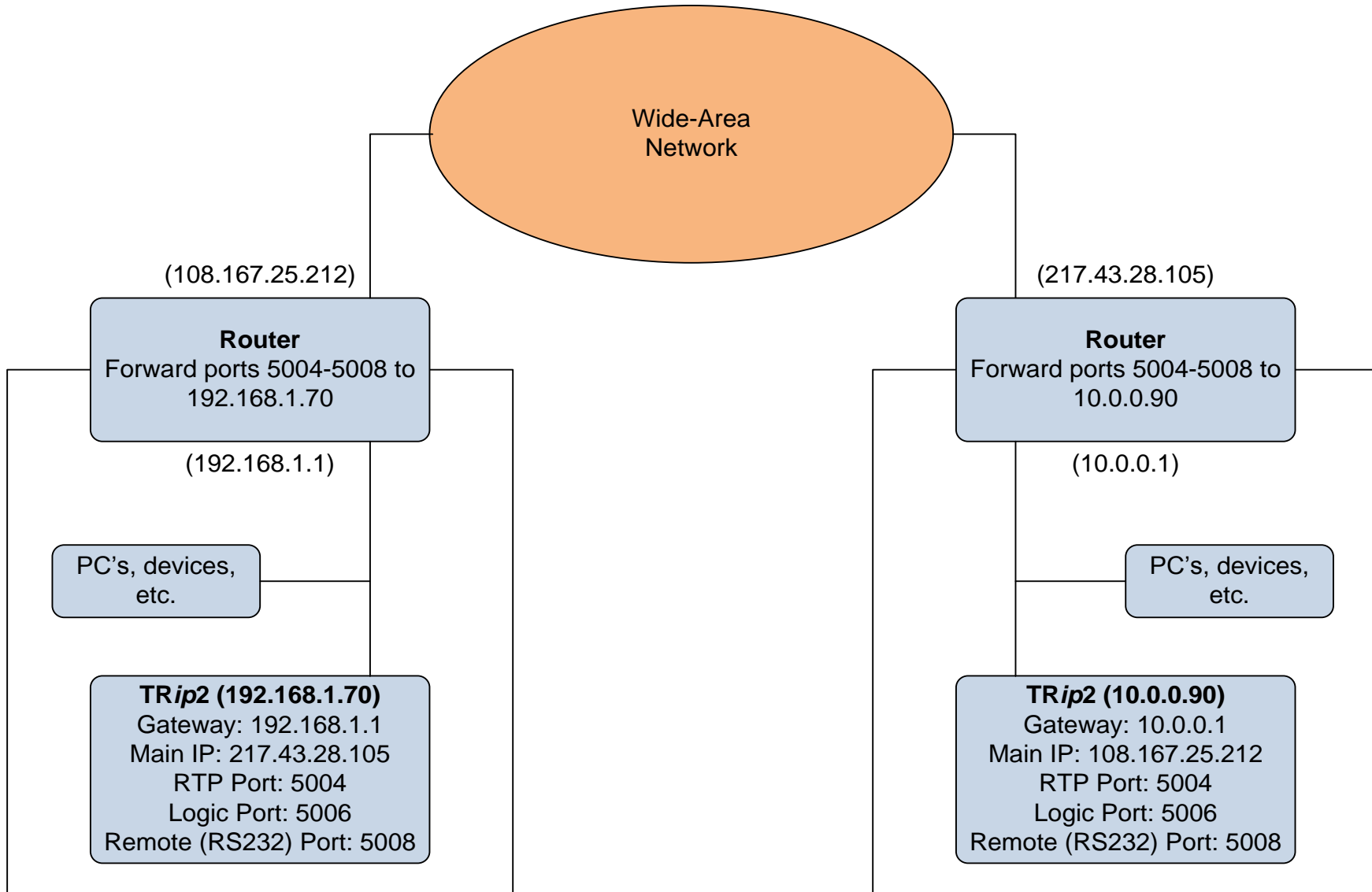Logic Port: 5006
Remote (RS232) Port: 5008

Figure 3: Example of two TRip2 units configured to talk across a wide area network using NAT