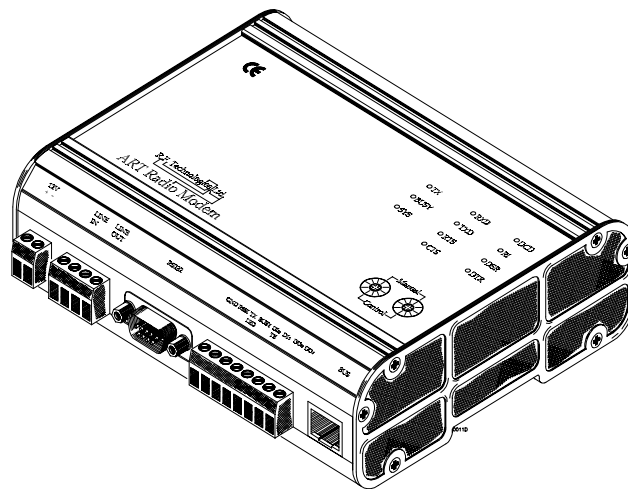


CHURCHILL CONTROLS

Data_Link 2000

ART *Narrow Band Radio Modems*



- *Complies with MPT1411, MPT1329, ETS300-220 & ETS300-113 plus Canadian, USA and Australian standards for licensed & license exempt operation*
- *Programming is via a PC or over the radio link with remote channel control for remote downloading of the new proposed MPT1411 band*
- *Internal full duplex soft modem with programmable & over the air speeds of: 150, 300, 600 1200 & 2400bps FFSK & FSK (including V23 & Bell 202) , 4800bps GMSK & 9600bps 4 level FSK within a 12.5KHz channel*
- *Very low power consumption in standby & receive modes with embedded real time clock for timed wakeup & time slotting*
- *Supports; Hayes, Modbus, DNP3, IEC870, PPP, SLIP, TCP and client specific protocols or will work in dumb mode*
- *Selectable RS232 or 5V TTL interface or RS485 with an adapter*
- *600Ω balanced audio input & outputs with tone operated transmit enable for external modem support*
- *Over-radio link software updates, programming, and remote control/adjustment of all functions such as RF power, channels, protocols, modes of operation, supply & temperature measurement, modem speed & RSSI reporting etc.*
- *Automatic remote frequency trimming over the network*
- *External I²C bus interface to support a range of I/O modules and GPS etc.*

- *Front panel LED's display RS232 functions, an optional 4 line LCD and keypad available if required*
- *Processors use large flash memories with expansion facilities & EEPROM with remote download capability – this includes devices on the internal & external I²C bus*
- *Simplex, semi-duplex & full duplex operation*
- *Separately synthesised TX & RX for fast RX to TX turn round time*
- *2 local digital inputs and 2 outputs*
- *Internal loopback facilities allow self testing of the product's parameters*
- *Internal temperature & voltage supply measurement capabilities*

INTRODUCTION

The ART was designed as a result of market research and will fit into almost any system using licensed or license exempt telemetry channels in the UHF band.

The ART Series are “State of the Art” product designed to operate in a multitude of systems. The unique features of the ART Series are the soft modem and the advanced microprocessor control of the product with all relevant parameters controlled by software. A large flash memory and EEPROM enables software upgrades, code changes or bespoke client code to be programmed via the serial port or over the radio link.

CHANNEL SELECTION:

The ART Series can be PC programmed with up to 80 channels. Alternatively, complete band allocations like the MPT1329 and MPT1411 bands as used within the UK can be downloaded, providing of course the channels are within the products tuneable bandwidth. Once programmed, channels can then be selected via rotary switches on the front panel (or via the keypad on the display version) , from a PC program, via the serial port or over the radio link.

Proposed MPT1411 Band Changes

The ART400 supports the new proposed MPT1411 channels. Unlike many products an entire system can be changed in a matter of minutes simply by plugging a PC into the base station and typing a band change command..

PROGRAMMABILITY:

All the parameters of the ART Series can be programmed via the serial port using either DOS or Windows 95/98 based software or over the radio link via the ART's secure “over air programming mode”. The individual program can be stored on disc for future use or printed.

POWER SAVE MODE:

The ART Series has both internal and external power save modes.

Internal Power Save Mode

The microprocessor controls the on/off function of the receiver and after a pre-programmed time the MPU will switch on the receiver to look for a carrier. If a carrier is not detected then the transceiver goes back into sleep mode. If during the time the transceiver is awake a carrier is received, the unit will stay awake. After the carrier drops out, the receiver will stay awake until the programmed resume time elapses. Once the resume time has elapsed the transceiver will go back into sleep mode. The save ON/OFF and resume time are all programmable via the PC program.

External Power Save Mode

In the external mode the ON/OFF function of the modem is controlled by the host via the DTR line.

Time Scheduling using the RTC

The ART contains an embedded Real Time Clock that can be used to wake the radio modem to process information, report back or be ready for a poll. The RTC can be synchronised during the wake-up communication for accurate time slotting.

SOFT MODEM:

The ART features a full duplex “soft modem” which offers unparalleled performance and flexibility over a wide range of speeds and formats and enables future formats to be downloaded from a PC or over the air. Within a 12.5KHz channel, the unit can be programmed for 150...2400bps FSK/FFSK with Bell 202 & V23 supported, 4800bps GMSK & 9600bps 4 Level FSK.

“RSSI” RECEIVE SIGNAL STRENGTH INDICATION:

Each ART has an internal individually calibrated RSSI signal which is accurately measured by an internal A-D converter. The signal strength can then be read in dB μ V on a PC connected to the serial port or remotely over the air. In the case of the LCD version the level can be directly read from the display. Alternatively the raw 0-5VDC relative to the RSSI is available on one of the connectors.

STATUS LED's

The ART has 11 LED's to enable the operator to see at a glance the status of the product and the serial port in operation or on test.

RF POWER

The ART'S are available in two power ranges: 10mW to 1 Watt for ultra low power requirement, and 20mW to 5 Watts. The calibrated RF power level is PC and over air programmable directly in Watts & Milli-watts with an accuracy of +/-1dB.

For higher powers an add-on 25Watt power amplifier is available.

LOCAL DIGITAL I/O

The ART Series has two local inputs and two outputs that can be configured and used under the Management and diagnostics software. For additional analogue or digital I.O the ART700 Series of I.O. modules can easily be connected to the I²C bus interface.

I²C INTERNAL & EXTERNAL BUS

The ART Series features an I²C Bus which is used to communicate with other modules over short or medium distances. The main feature of the bus is its address mode, which will only wake up modules that are being addressed, thereby ensuring low power operation.

INTERNAL/EXTERNAL MODEM OPERATION

Both internal and external modems are supported, the external interface provides both flat and de/pre-emphasised response for compatibility with older systems.

External

In external mode the 600 Ω input and output will accommodate a programmable range of +3...-30dBm. The output can be muted in the absence of a carrier.

Tone Operated Switch (TOX)

When using an external modem via the 600 Ω port, the soft decoder within the ART400 can be programmed to detect incoming FFSK or PSK signals. Once detected the transmitter will key up and pass the incoming data.

Internal

The internal modem is PC programmable and is compatible with the many products in operation around the world. In the internal mode, data is presented to the modem via the RS232/TTL port at speeds up to 38400 and transmitted at the programmed baud rate. Buffering is provided when the data rate is higher than the transmission rate.

DUAL SYNTHESISERS:

The ART has dual synthesisers for the receiver and transmitter to enable full duplex operation, but in the semi-duplex mode the receiver can be left on to achieve a very quick turn around time.

MODES OF OPERATION & PROTOCOL HANDLING

Radio Modem Modes of Operation

The basic modes of operation of the radio modem are as follows:

Dumb modem

The radio has no knowledge of the data it is transmitting, data is simply transmitted and received under hardware control with the option of RTS control or initiation of transmit after receipt of serial data, with CTS providing an optional flow control.

This configuration is useful when expanding older systems where the radios must be compatible with others of a different manufacture.

Protocol specific modem

The radio recognises a complete frame and only transmits and receives data conforming to that format. No addressing of radios or routing of data is performed. Protocols such as MODBUS, IEC870 & DNP3 can be supported in this way.

Routing modem

The radios recognise a protocol specific frame and the address to which the frame is to be sent. Routing information must be stored in each radio for each destination address that requires the use of repeaters. Any radio in the system can operate as a repeater. The radio does not perform any acknowledgement or retries. Any protocol using a fixed address field such

as MODBUS can be supported.

Dial up modem

Hayes protocol is used to dial up the radio link which may include repeaters or store & forward stations, the route information is not stored but is passed in the dial up command in the form of a telephone number, once the link is established it is transparent and so independent of the protocol being transported. This allows point to point protocols such as SLIP and PPP (and hence TCP/IP) to be conveyed. Dial up is less efficient for small data transactions because of the data transactions carried out during the connect the disconnect phases.

I/O MODES OF OPERATION

Isolated network with point to point I/O mapping

Inputs and outputs at outstations are mapped to corresponding outputs and inputs at the master.

Network with retrieved data access at base station.

Instead of mapping data to physical inputs and outputs at the master, data is exchanged in memory. The memory is accessible using MODBUS. The base station carries out its data retrieval process independently of the MODBUS accesses.

Externally controlled network

In this mode the base station only carries out data retrieval when requested to do so by the MODBUS interface.

The above modes are not independent processes but are run according to set up, it is possible to configure operation to be a mix of all three. E.g. some physical I/O might be desirable at the base station whilst the rest is passed by MODBUS, the base station can be set to keep polling independently in order to maintain the physical I/O but can also mix in commands passed by MODBUS

Custom Protocols

Custom protocols can be written and downloaded via a PC or over the air as systems require change, thereby minimising disruption.

Should a special protocol or interface be required please contact the sales office.

NETWORK MANAGEMENT SOFTWARE

Network management software provides the user with direct access to the radio modems, for

diagnostics, programming & re-programming, safe downloading of new firmware and the for the retrieval of data. All products on the I²C bus can be accessed in the same way.

SQUELCH TAIL ELIMINATION

For old or non tolerant protocols, where the presence of a mute (Squelch) tail may cause a problem at the end of a message, a simple packetising option can be enabled.

FORWARD ERROR CORRECTION (FEC)

Forward error correction is not implemented as standard in the modem because of the loss of throughput in good signal situations, however FEC can be offered as a custom option if required. Note that since the internal modem offers many data speeds data integrity can be improved simply by running a lower speed.

AUTOMATIC FREQUENCY CONTROL

The network management software, enables the outstation's receiver and transmitter to be frequency locked onto the base station's frequency and automatically re-aligned, thereby minimising the effects of long term drift (Ageing). This includes up to 6 repeaters.

TX TIME-OUT TIMER

The transmitter within the ART has a time-out-timer which allows the maximum continuous transmission time to be set in order to prevent channel blocking due to a to fault. The timer operates in all modes and can be programmed in one second steps between 0 and 255 seconds. If programmed and the time is exceeded, transmission will cease until the action that normally causes transmission is removed and then re-applied.

DUAL CONTROLLER FOR A FULLY DUPLICATED OUTSTATION

For Base Station applications we have available the BRT Series, also the ART products can work in a fully duplicated mode for critical outstation applications with the aid of an ART790 DIN bay changer module.

PROGRAMMING INSTALLATION, SERVICE & NETWORK MANAGEMENT SOFTWARE

Dedicated PC software packages have been written to provide unrivalled versatility combined with ease of use to the user.

Programming software

Programming software in DOS and Windows 95/98 is available for the ART Series.

Installation Software

Provides engineers with relevant software tools to align antennas, check path links in both directions and remotely adjust the RF power at each end and log the RSSI levels.

Service Software

Service software is available to enable competent engineers to perform first line testing of the product and re-alignment when used in conjunction with suitable test equipment.

Network Management Software

Network Management software has been designed to enable system operation and performance to be monitored.

OPTIONS AND ACCESSORIES

DIN Uninterruptable Power Supplies with Chargers

- ART750 80...250VAC to 12VDC 3 Amps with backup battery charger & fault reporting via the I²C Bus
- ART751 18...60VDC to 12VDC 3 Amps isolated with backup battery charging and fault reporting via the I²C bus

DIN Mountable RF Power Amplifier

- ART400PA-25 UHF 5...25W RF power amplifier with built-in VSWR facility that measures Forward & Reflected power and conveys the information back to the ART400 via the I²C bus.
- ART170PA-25 VHF 5...25W RF power amplifier as the ART400PA-25

Manuals & Connecting leads

Programming, installation and operations manual

TECHNICAL SPECIFICATIONS

General

Frequency Range:	ART400TR	406...512MHz
Power Requirements:	12VDC (10V...15.5VDC)	
	Standby:	< 75uA
	Receiver on & decoding:	<65mA
	Transmitter:	Dependant on Power
Number of Channels:	80 user programmable frequencies or all UK pre-programmed MPT1411 & MPT1329 channels	
Min. Programmable Channel Step:	6.25 or 5KHz	
Channel Spacing:	12.5KHz	
Operating Temp. Stability:	2ppm -30...+60°C	
Construction:	Milled aluminium enclosure	
Size:	160mm W x 125mm L x 45mm H	
Mounting:	DIN or can be screwed to a flat surface	
Weight:	750gms	
Connectors:	RS232:	9 Way "D" Type
	12VDC	2Way Klippon Type
	I/O	8Way Klippon
	Line	4Way Klippon
	I ² C	10Way RJ45
	RF	BNC
Led Indicators:	TX, Busy, System, RXD, TXD, RTS, CTS, DCD, DTR, DSR, RI	
Approvals:	The products have been designed to meet the following approvals.	
	UK RF :	MPT1411, 1329
	European RF:	ETS 300-220
		ETS 300-113
		ETS300-224
	Australian:	AS4268.2-1995
	USA:	FCC Part 90/15
	Canadian:	DOC
	European CE:	IETS 300-683

Transmitter:

RF Output Power:	1Watt unit:	10mW...1W
	5watt unit:	50mW...5W
	Type is signified by ART400TR-1 or -5	
Bandwidth:	Without alignment:	20MHz
Modulation:	Digital: FFSK, 2 Level FSK, 4 level FSK & GMSK via the internal modem	
	Analogue: Programmable over the range +3dBm to -30dBm into 600ohm, with a programmable pre-emphasised or flat response.	
Max. Deviation:	± 7.5KHz	
Adj. Channel Power:	>65dB	
Hum and Noise:	>-37dB	
Spurious Emissions:	< 250nW & 4nW in specified bands	

Transient response: As per ETSI300-113
Rise Time: < 5mS

Receiver:

Sensitivity: 0.25uV for 12dB SINAD
Bandwidth: Without re-alignment: 12MHz
Spurious Response: > 77dB
Blocking: > 95dB relative to 1uV
Intermodulation: > 70dB
Adjacent Channel: > 65dB at 12.5KHz
IF Frequencies: 45MHz and 455KHz
Spurious Emissions: < ETS300-220/113
Audio Output: Programmable over the range +3dBm to -30dBm into 600 ohms, with a programmable de-emphasised or flat response
Mute Response Time: < 3msec

Internal Modem

Serial Interface: Asynchronous or Synchronous with custom software. Baud rate programmable between 150bps and 38400bps. Interface selectable for RS232 or inverted/non-inverted 5V TTL, programmable odd, even or no parity, 1-2 stop bits, 7-8 data bits.
Signalling Formats: Programmable V23, Bell 202, FFSK, 2 level FSK, 4 Level FSK & GMSK.
NRZI: On or Off
Baud Rate: 150...9600bps within 12.5KHz
Bit Error Rate: 2400 baud: Less than 1 in 10^3 at -120dBm
4800 baud: Less than 1 in 10^3 at -117dBm
9600 baud: Less than 1 in 10^3 at -112dBm

In the interest of improvement the above specifications are subject to change without notice.

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