

The CMC56 Leased Line Modem

Introduction

The CMC56 was designed out of a need for a product which would transmit and receive data reliably over long distances and which would re-start automatically in the event of power failure or a failure in the line.

The CMC56 uses the Conexant (previously Rockwell) RC36D Digital Signal Processor (DSP) as is found in many modern modems for use with PCs. There is the option to use instead the RC56D DSP for higher speeds. The DSP requires a set of commands in order for it to operate and this is normally provided by the PC itself via the AT command protocol but this requires an additional microprocessor to interpret the commands and talk to the DSP. This is far too complicated for a modem link over a leased line. In many cases, commercial modems are only supplied with dial-up AT commands so could not be used over a leased line in any case.



The CMC56 comprises the following parts:

1. Full specification transformer-coupled V34 interface with an RJ11 telephone socket. An option is also provided for connection to dial-up lines and this can be adjusted for different countries. However, local approval may be required.
2. Conexant RC36D or RC56D DSP.
3. Motorola 68HC908JL3 microcontroller with self-starting software to interface to the DSP. Also included is a serial EEPROM for storage of parameters or event history. The 68HC908 program by-passes the AT commands which are normally in a conventional modem used by talking directly to the DSP. A 9600 baud RS232 port is provided for connecting a dumb terminal or lap-top PC for interrogation or programming of the system but in simple systems there is no need to use this port. This 'diagnostics' port is in addition to the main data port in (5) below.
4. Option: RS422 2-wire port with fixed direction - selectable with jumper.
5. RS232 interface to the leased line. This port, although operating over a 2-wire leased line, operates in full duplex, of course, and simultaneous transmissions may operate in both directions.
6. Option: 4-20ma current-loop full duplex interface to the leased line. This was originally designed to interface to Caradon Trend network controllers but may be adapted for any current loop devices.
7. Diagnostic LEDs and loudspeaker. The LEDs indicate (1) if a signal is being received from the remote end and (2) whether the two modems have established contact. A further LED flashes if the modem is waiting to establish contact with the remote end.
8. Power Supply. Power requirements for the CMC56 are 7-20vdc at 80mA. Most parts of the modem operate at 3v. The input is firstly dropped to 5v and then to 3v, hence the two regulators which are visible in the photo.
9. 8-way Bit Switch
10. Originate / Answer jumper (SW2)

Operating a pair of CMC56 modems over a line is extremely simple. The only adjustment that must be made is to ensure that one modem is configured as Originate and the other as Answer. This is done by installing a link in SW2 in the Answer modem, that is all that has to be done. Switch on both ends of the link - it is not necessary for this to take place at the same moment in time. The first modem to be switched on (it is not important which) will simply wait in a continuous loop until it hears the other modem at the other end of the line. Communication is extremely reliable but a break in power or in the line will simply return both modems back to their waiting loop.

All parts of the sequence are indicated in a set of diagnostic LEDs on the circuit board so the user can check if necessary the state of the link. However, normally this would not be necessary - the whole point of the product is to plug it in and forget it.

All transmissions through the link are 'transparent'. In other words, what goes in one end will come out of the other end without any extra or missing characters but there is a delay of about 100ms through the modem pair due to DSP processing. In this mode of operation, it is not necessary for the modem to have any knowledge of the data that is passing through it providing it is not greater than 19k2 baud - this being the transmission rate at which we test the units. However there is no reason why the CMC56 will not operate up to the maximum data rate of the Conexant DSP (ie 56K baud depending on which is fitted).

Technical Description

The HC908 processor includes self checking as well as monitoring the link and is fail-safe. If there is an error then it will automatically re-start itself and re-connect the link.

The range of the transmission is limited only by the quality of the connection. The required bandwidth is the same as a normal dial-up telephone line so, providing the cable satisfies this specification, then the modem will operate reliably.

The Bit Switch

The bit switch serves two alternative uses:

It may be used for status inputs, for example from plant alarms which are then automatically communicated to the other modem. It may also be used for setting parameters such as baud rate.

The HC908 processor selects the baud rate (typically 19k2) and bit format (typically 8,n,1) and initialises the Conexant DSP with these parameters. Alternative parameters may be stored in the serial EEPROM chip by using the Setwin3 diagnostics software provided which requires Windows 95 or later. The processor will also recognise a limited AT command set, ie using only those commands which it needs.

In order to initiate communications, a pair of modems must comprise an Originate modem (J14 jumper removed) and an Answer modem (J14 jumper fitted).

Once the pair of modems are trained, communications can take place in either direction at the same time - ie, full duplex. Modems are trained when all three green LEDs are extinguished.

Diagnostics LEDs

D2	Red	Indicates data being received from the local data source-
D3	Red	Activity indicator (see below)
D4	Red	Not used
D5	Red	Not used
D6	Red	Repeats status of Originate/Answer - illuminated=Originate
D7	Green	_DSR (not data set ready - low when locked)
D8	Green	_CTS (not clear to send - low when ready to receive data)
D9	Green	_RLSD (receive line signal detector - low when receiving signal from other modem)

D12 Red +5v

The activity LED pulses at one second intervals when the processor has attempted to re-start the Rockwell DSP. Normally, this LED is not illuminated.

Software notes

On power-up or Hard Reset, the HC908 processor will immediately place the DSP in Originate or Answer mode depending on the state of the relevant bit switch. The DSP will remain in this state until it sees an opposite modem at the other end of the line. It doesn't matter if there is a long delay between switching on two modems of a pair. As soon as the second modem is powered up, you will hear them attempt to lock (providing you're not in a noisy plant room!). This procedure takes about 10 seconds.

Once the two modems are communicating, there is no reason why they should not do so for a long time. However, the HC908 processor constantly checks for any breaks in transmission. The checks are the same at each end of the line. Conexant does state in their manual that, for long-term connections such as exist with the CMC56 the DSP needs to re-train every 24 hours and this may be automatic or manually controlled, eg during a quiet period when a 15 second break in communications is not critical.

The HC908 checks the three green LEDs and, if any one is illuminated, it sets a timer (D3 flashing) at the end of which period it re-sets the DSP as though it had been switched on. Meanwhile, the modem at the other end of the line will also have detected the failure in communications and will also reset itself. This routine has been tested extensively in the field. The HC908 also monitors EQM (eye quality monitor) from the DSP which, for some baud rates, is a more accurate measure of transmission quality.

Setwin3 Software

Setwin3 is a diagnostics and setup program which will run typically on a portable computer but in many cases the modems would be set up in an office prior to shipment to site. Providing the user knows the baud rate at which the modems will be used then they may be shipped from Applied Microsystems ready to go and with no further set-up required.

We hesitate to describe Setwin3 as it might suggest that it is a part of the setting up of the modem whereas it was primarily used during the software design of the product and is therefore offered to clients who may be interested to see how the system operates internally. The simplest way to set up a CMC56 is to use a dumb terminal such as Hyperterminal in Windows.

Who is using the CMC56?

The original leased line modem was the CM336 and this was designed to help a client out of a difficult situation. They had installed a Trend network in a hydro-electric project in Malaysia but had overlooked the great distances between nodes and the network would only run at its very slowest speed. The CM336 was designed with the required 4-20ma interface for the Trend boxes and the network has been running now for several years at its full speed of 19k2 baud.

The later products based on the Conexant 3 volt chips have been used by a company manufacturing mining equipment (great distances, vertically) - a special version was designed for them, BT have used both the leased line version and also a dial-up version which is not covered in this manual (but please ask if you require more information). The earlier CM336 modem is used by Southampton Geothermal to connect their various sites around the city.

We offer the CM56 to you!