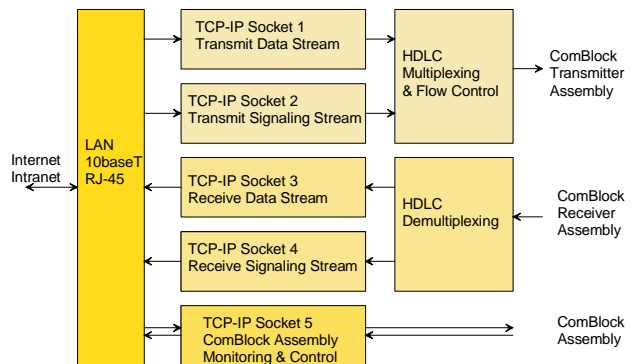


Key Features

- Provides high-speed network interface for data transfer and monitoring & control of ComBlock assemblies.
- Standard 10baseT LAN interface, RJ-45 connector.
- Support for multiple data streams, with a standard TCP-IP socket for each stream.
- HDLC multiplexing of two transmit streams:
 - transmit data channel.
 - signaling channel.
- HDLC demultiplexing of two receive streams:
 - receive data channel.
 - signaling channel.
- Elastic buffering and flow-control on each transmit and receive link.
- Monitoring and control of ComBlock assemblies over LAN or serial link from a graphical user interface.
- Single 5V supply
- Connectorized 3"x 3" module for ease of prototyping. Standard 40 pin 2mm dual row connectors (right, bottom)



5 Virtual Channels



For the latest data sheet, please refer to the **ComBlock**

web site: www.comblock.com/download/com5001.pdf.

These specifications are subject to change without notice.

For an up-to-date list of **ComBlock** modules, please refer to www.comblock.com/product_list.htm.

Interfaces

Interface	Definition
LAN	4 wire. 10baseT. RJ45 connector. NIC wiring.
ComBlock Module Interface	2 40-pin connectors to two other ComBlock modules. The interface is programmable as a function of the adjacent ComBlock module type.
Serial Monitoring & Control	DB9 connector. 115 Kbaud/s. 8-bit, no parity, one stop bit. No flow control.
Power Interface	4.75 – 5.25VDC. Terminal block. Power consumption is 250mA.

Initial Configuration (via Serial Link)

The IP address, IP mask, Gateway IP address and DNS address must first be configured over serial link. These network settings are saved in non-volatile memory. Once the correct network settings are configured, the Comblock Control Center and this ComBlock assembly can communicate over the intranet or internet as well as over a serial link.

Configuration (via Serial Link / LAN)

Complete assemblies can be monitored and controlled centrally over a single serial or LAN connection.

The module configuration parameters are stored in non-volatile memory. All control registers are read/write.

Parameters	Configuration
IP address	4-byte IP address. Example : 0x AC 10 01 80 designates address 172.16.1.128 The ComBlock must be reset for the new address to become effective. REG0: MSB REG1 REG2 REG3: LSB
IP mask	4-byte IP mask. Determines whether an address is local or remote. Example : 0x FF FF FF 00 designates the mask 255.255.255.0 The ComBlock must be reset for the new mask to become effective. REG4: MSB

	REG5: REG6: REG7: LSB
Gateway IP	IP address of the gateway to the Internet. Packets to remote IP addresses are forwarded through the Gateway. REG8: MSB REG9 REG10 REG11: LSB
DSNI	Domain name server1 IP address. REG12: MSB REG13 REG14 REG15: LSB
Reserved	REG16, REG17, REG18, REG19
Input format	00000 = disables input connector. 00001 = 1-bit wide 01000 = 8-bit wide 11110 = loop back 1-bit serial mode. 11111 = special case: bi-directional connection to COM-7001 via input female connector (output connector must be disabled). REG20 bits 4-0
Receive HDLC enable	Perform HDLC decoding on 1-bit serial receive stream (applicable only when 1-bit input serial format is selected). 0 = no 1 = yes REG20 bit 7
Output format	00000 = disables output connector. 00001 = 1-bit wide 01000 = 8-bit wide 11111 = special case: connection to COM-7001 via output male connector (input connector must be disabled). REG21 bits 4-0
TCP-IP timeout reset enable/disable	Enable or disable automatic reset of the TCP-IP connection if no data is received over the TCP-IP port for two minutes. When enabled, a timeout condition will close the existing connection and immediately re-open the socket in listening mode. Justification: abnormal connection terminations may not be detected by the TCP-IP receiving end, thus preventing the TCP-IP sending end from re-establishing a new connection. The ComBlock must be reset for this new setting to be applied. 0 = disable automatic timeout reset. 1 = enable automatic timeout reset. REG21 bit 5
Transmit mode	00 = no formatting. The data source must be ready to fill the IP port 1024 to avoid underflow in the transmit elastic buffers.

	<p>01 = text mode (insert NULL characters as gap filler). Use when the data source throughput is less than the synchronous link throughput.</p> <p>10 = HDLC mode. Perform HDLC encoding on 1-bit serial transmit stream (applicable only when 1-bit output serial format is selected). Use HDLC to multiplex data and signaling information as two virtual channels on the same physical link. REG21 bits 7-6</p>
Internal / External clock selection	<p>0 = internal clock 1 = external clock REG22 bit 0</p>
COM-8001 external trigger	<p>Special use: Writing to REG22 with a '1' in bit 1 will generate a 1 CLK wide pulse on pin J3/B6. The main application is to trigger the COM-8001 file playback/download. There is no need to reset this bit to '0' prior to writing a '1'. REG22 bit 1.</p>

Note: changing any of the configuration values or reloading the current configuration will close and re-open all TCP-IP connections.

Monitoring (via Serial Link / LAN)

Parameters	Monitoring
Transmit data elastic buffer empty	<p>0 = not empty 1 = empty REG23 bit 0</p>
Transmit signaling elastic buffer empty	<p>0 = not empty 1 = empty REG23 bit 1</p>
Transmit data elastic buffer less than half full	<p>0 = more than half full 1 = less than half full REG23 bit 2</p>
Transmit signaling elastic buffer less than half full	<p>0 = more than half full 1 = less than half full REG23 bit 3</p>
LAN Activity	<p>0 = inactive 1 = active REG23 bit 4</p>
Receive data elastic buffer more than half full	<p>0 = less than half full 1 = more than half full REG23 bit 5</p>
Receive signaling elastic buffer more than half full	<p>0 = less than half full 1 = more than half full REG23 bit 6</p>
HDLC decoding error	<p>0 = no error 1 = error detected REG23 bit 7</p>

Number of bytes transmitted from LAN to digital device	<p>Total number of bytes transmitted over data and signaling channels. 32-bit byte count. Counter rolls over when reaching 0xFFFFFFFF. REG24: bits 7-0 (LSB) REG25: bits 15-8 REG26: bits 23-16 REG27: bits 31-24 (MSB)</p>
Number of bytes received from digital device and forwarded to LAN	<p>Total number of bytes received over data and signaling channels. 32-bit byte count. Counter rolls over when reaching 0xFFFFFFFF. REG28: bits 7-0 (LSB) REG29: bits 15-8 REG30: bits 23-16 REG31: bits 31-24 (MSB)</p>
Version	<p>Returns '5001xy' when prompted for version number.</p>

As the monitoring data is constantly changing, it is important to be able to prevent changes while reading a multi-byte parameter. The monitoring data is latched upon reading register 23. Therefore, register 23 should always be read first.

Test Configuration Example

- [LAN COM-5001 -> LAN COM-5001](#)

This test setup aims at demonstrating the TCP-IP transmission from one network data source to another network data sink. The incoming data is received over the LAN using TCP-IP at port 1024. The TCP-IP data stream is converted to a 40 Mbit/s synchronous serial data stream at the interface between the two COM-5001 modules, then converted back to TCP-IP packets. The packets are placed for reading at TCP-IP port 1026.

First configure each COM-5001 with a unique TCP-IP address consistent with your LAN network. Here we assume that local addresses are in the form 172.16.1.X, where X = 1 to 254. The first COM-5001 is assigned address 172.16.1.128, and the second COM-5001 assigned the address 172.16.1.129. Please check with your network administrator for IP mask and available IP addresses.

The registers settings are as follows:
first COM-5001:AC 10 01 80 FF FF FF 00 AC 10
01 01 00 00 00 00 00 00 00 00 81 00

second COM-5001:AC 10 01 81 FF FF FF 00 AC
10 01 01 00 00 00 00 00 00 00 81 00 01

Proper operation can be verified as follows:

(a) Upon connecting the LAN cable to the RJ-45 connector, the yellow LED close to the connector is ON.

(b) Using the ComBlock Control Center, go to the communication setup window, select LAN/IP and

- ping the first address (172.16.1.128 in this example). The ping test should indicate 4 out of 4 successes.
- ping the second address (172.16.1.129 in this example). The ping test should indicate 4 out of 4 successes.

(c) Using two terminal emulators such as Hyperterminal:

- open two TCP-IP connections, one to address 172.16.1.128, port 1024, the other to address 172.16.1.129 port 1026. The Hyperterminal should indicate 'connected' in the lower left corner of the window.
- Configure the sending Hyperterminal to display the characters sent (ASCII setup "Send line ends with line feeds" and "echo characters typed locally").
- Send a large text file using the menu "Transfer | Send text file".
- Observe the file being received in the other Hyperterminal window. Comparing transmit and received file should show no errors.
- Note that the last characters are 'stuck' in the LAN buffer due to the HDLC packet implementation. At the end of a transfer, the transmitter should be flushed with 4096 NULL characters.

IP Protocols

This module supports the following IP protocols:

- Ping
- ARP
- UDP
- TCP-IP

Ping

The module responds to ping requests with size up to 500 bytes.

TCP-IP

The module opens the following sockets in listening mode:

- Port 1024: transmit data stream
- Port 1025: transmit signaling stream
- Port 1026: receive data stream
- Port 1027: receive signaling stream.
- Port 1028: monitoring and control port

UDP-IP

Port 1029 is open as a UDP receive-only port. This port serves a single purpose: being able to reset all TCP-IP connections gracefully. The command "@001RST<CR><LF>" sent as a UDP packet to this port will reset all TCP-IP connections.

Operation

Throughput

The COM-5001 is capable of a sustained (average) throughput in the range 390 Kbps to 890 Kbps. The peak transfer rate is only limited by the 10baseT LAN.

HDLC

HDLC allows to transmit a variable rate (asynchronous) data stream over a fixed rate continuous (synchronous) link like a satellite or wireless link. Whenever no data is available for transmission, the HDLC encoder generates empty frames to fill the synchronous data link. Empty frames are discarded during HDLC decoding.

HDLC also allows to multiplex multiple data streams over a single link, in effect creating virtual channels. In this module, two virtual channels are generated in each direction: one for data, one for signaling. Data has priority over signaling: if signaling information is only transmitted when no data is available for transmission.

The HDLC encoding/decoding is user-enabled. HDLC must be used with the 1-bit serial format on the HDLC-encoded side.

This implementation of HDLC adds little overhead (less than 1 %):

Each HDLC frame is 512 bytes (4096 bits) long.

The format is as follows:

Byte 1: address flag 0x1 for data, 0x2 for signaling

Byte 2 – 509: payload data

Bytes 510-511: 16-bit CRC.

During HDLC encoding, bit stuffing adds a zero bit after 5 consecutive ones. The resulting HDLC-encoded frame is delineated with two 0x7E flags.

The user application must ensure that at least 4096 empty data bits are transmitted at the end of each session to flush the buffers.

Text Mode

Text mode enables one to send non-null ASCII characters over the synchronous link with minimum latency. When text mode is enabled, NULL (ASCII 0) characters are inserted when no other characters is received at IP port 1024. At the receiving end, all characters, including the non-printable NULL character, are forwarded to IP port 1026.

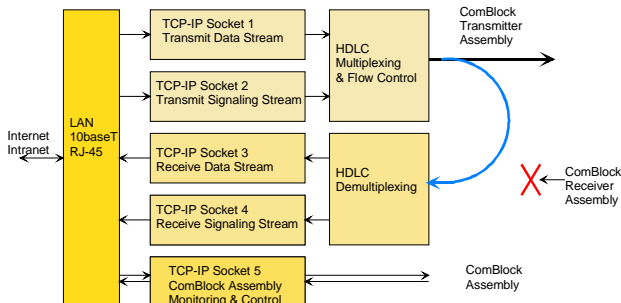
Format Conversion

Parallel to serial conversion occurs at the output when a 8-bit byte received over the TCP-IP link is converted to n-bit serial, where the sample width n is selected by the user. The key rule for parallel to serial conversion is that the most significant bit (MSb) is transmitted first.

Likewise, in the serial-to-parallel conversion which occurs at the input, the first received bit is placed at the MSb position in the byte.

Loop Back

A loop back mode is provided for system-level test purposes. Transmitted data are looped back into the 1-bit serial input. The nominal input pins are disabled. Be sure to configure the output format as '1 bit serial'. Loop back mode can be used with or without HDLC.



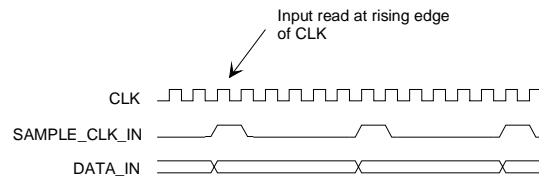
MAC Address

Each COM-5001 has a unique 48-bit MAC address. The 3 least significant bytes are printed on a 6 hex digit label on the small adapter board with the RJ-45 connector. The 3 most significant bytes are 00 90 C2.

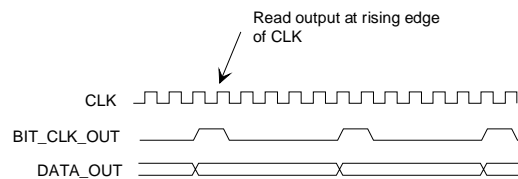
Timing

The I/O signals are synchronous with the rising edge of the reference clock CLK (i.e. all signals transitions always occur after the rising edge of the reference clock CLK). The maximum CLK frequency is 40 MHz.

Input



Output



LEDs

2 LEDs located close to the LAN RJ-45 jack provide summary information as to the LAN: Link and activity.

Test Points

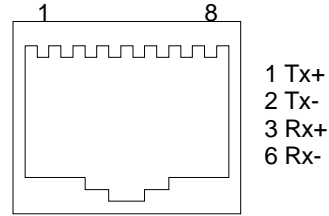
Test points are provided for easy access by an oscilloscope probe.

Test Point	Definition
TP 1	Transmit data elastic buffer empty 1 = empty
TP 2	Transmit signaling elastic buffer empty 1 = empty
TP 3	Transmit data elastic buffer less than half full 1 = less than half full
TP 4	Transmit signaling elastic buffer less than half full 1

	= less than half full
TP 5	LAN Activity 1 = active
TP 6	Receive data elastic buffer more than half full 1 = more than half full
TP 7	Receive signaling elastic buffer more than half full 1 = more than half full
TP 8	HDLC decoding error 1 = error detected
TP9	
TP10	

LAN Connector J2

The RJ-45 Jack is wired as a standard PC network interface card. Connection to a LAN Hub is over a straight-through cable.

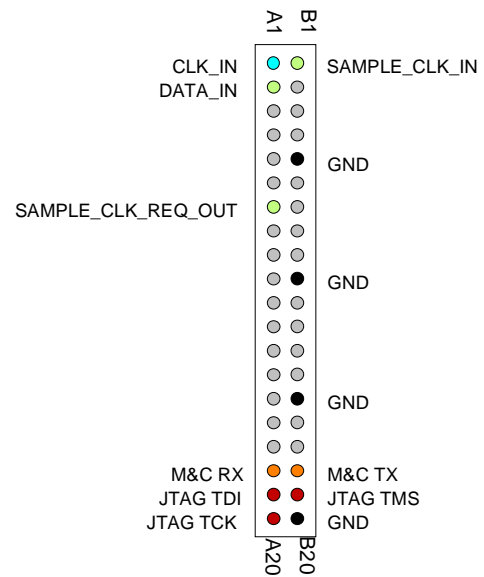


RJ-45 Jack

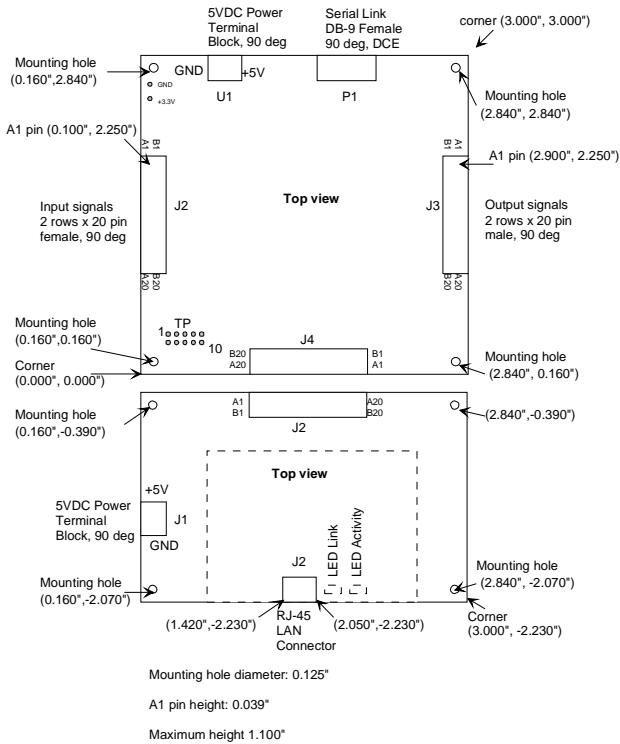
Input Connector J2

There are several possible connector configurations, depending on the application:

(a) 1-bit wide connection to another ComBlock [COM-1001, COM-1011, etc]



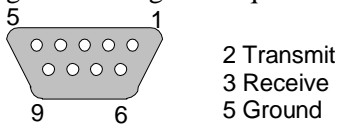
Mechanical Interface



Pinout

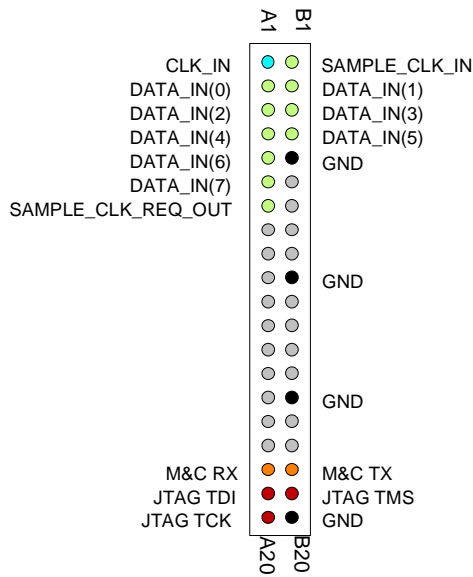
Serial Link P1

The DB-9 connector is wired as data circuit terminating equipment (DCE). Connection to a PC is over a straight-through cable. No null modem or gender changer is required.

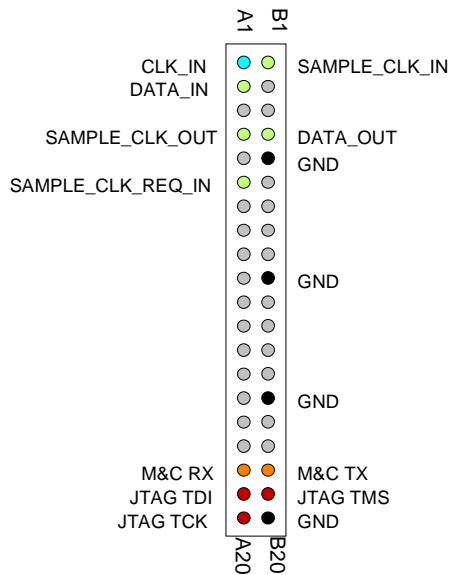


DB-9 Female

(b) 8-bit wide connection to another ComBlock [COM-8002,etc]



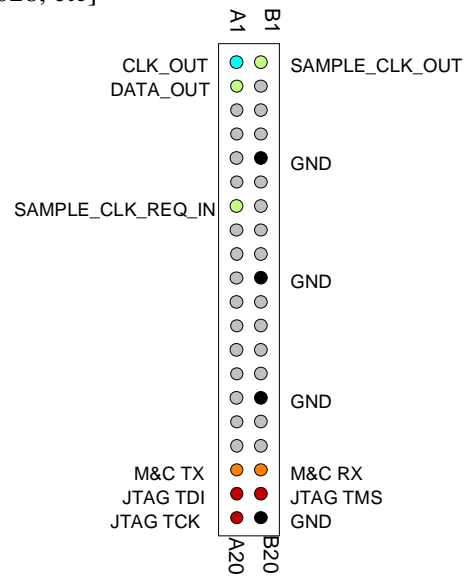
(c) Special case: input connector is used for bi-directional connection to COM-7001 module.



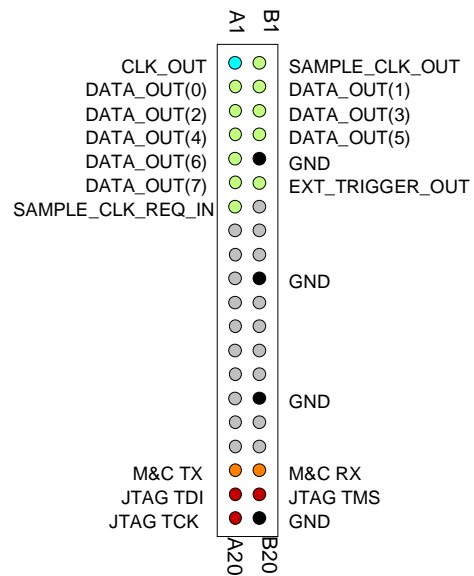
Output Connector J3

There are several possible connector configurations, depending on the application:

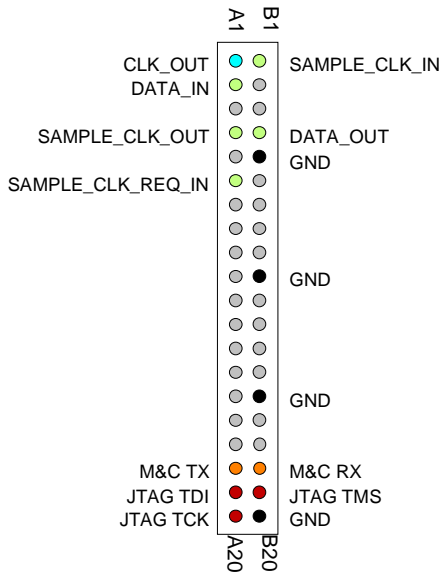
(a) 1-bit wide connection to another ComBlock [COM-1002, COM-1012, COM-1019, COM-1028, etc]



(b) 8-bit wide connection to another ComBlock [COM-8001, etc]



(c) Special case: output connector is used for bi-directional connection to COM-7001 module.



I/O Compatibility List

(not an exhaustive list)

Input	Output
COM-1001 BPSK/QPSK/OQPSK Demodulator	COM-1002 BPSK/QPSK/OQPSK Modulator
COM-1011/1018 DSSS Demodulator	COM-1012/1019 DSSS Modulator
COM-7001 Turbo Code Encoder / Decoder	COM-7001 Turbo Code Encoder / Decoder
COM-8002 Data acquisition module	COM-8001 Arbitrary Waveform Generator

Configuration Management

This specification is to be used in conjunction with VHDL code template software revision 25, and the ComBlock Control Center revision 2.31 or above.

ComBlock Ordering Information

COM-5001 LAN / IP NETWORK
INTERFACE

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