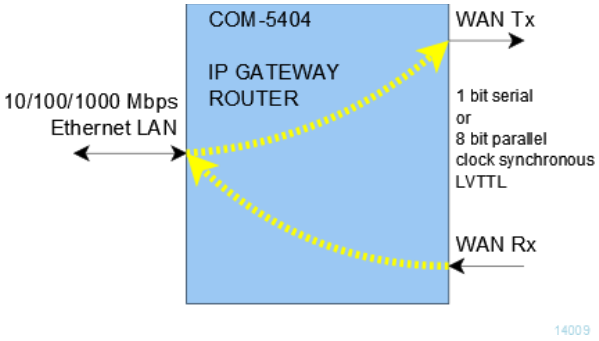
COM-5404 GbE IP GATEWAY ROUTER

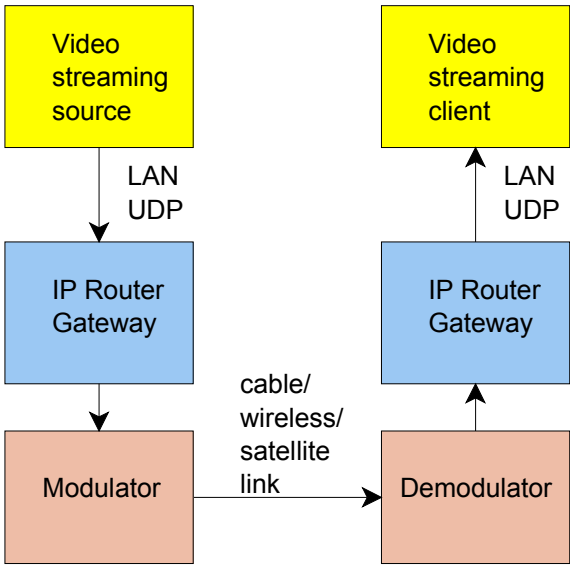
Key Features

- The COM-5404 is a layer 3 IP router which acts as gateway between a gigabit Ethernet (GbE) LAN and a digital clock-synchronous link to/from a remote WAN
- IP frames can be forwarded and received as 8-bit parallel or 1-bit serial data streams
- A CRC is attached to each transmitted IP frame for error detection at the receiving end
- 1-bit serial streams are HDLC encoded and scrambled
- IP offload engine (all IP protocols implemented in FPGA/VHDL) for maximum throughput performance and very low latency. Maximum throughput 950 Mbits/s (8-bit parallel interface) or 125 Mbits/s (1-bit serial interface)
- Complies with IPv4 routers specifications RFC1812
- Built-in DHCP server automatically assigns IP addresses to local IP clients, for ease of network management
- Built-in DHCP client can be enabled to automatically fetch an IP address
- Single 5V supply. Standard 98-pin PCIe female connectors



Typical application is to bridge islands of IP-based networks through satellite / wireless / cable modems:

- Two-way IP communications
- UDP video streaming
- IP datacasting



Example: one-way video streaming over UDP

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Telephone: (240) 631-1111 Facsimile: (240) 631-1676 www.ComBlock.com
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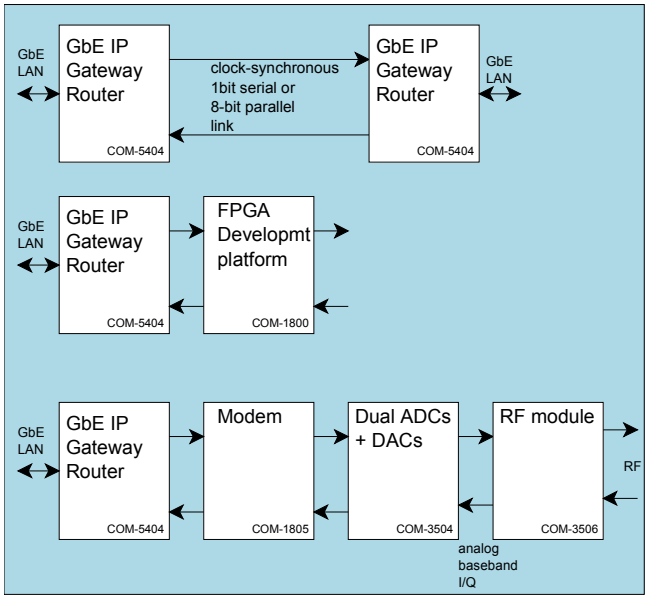
Inputs/Outputs



For the latest data sheet, please refer to the **ComBlock** web site: comblock.com/download/com5404.pdf.
These specifications are subject to change without notice.

Interfaces

Input Signals	Definition
WAN_RX_DATA _IN[7:0]	Input data from the WAN. The data width can be 1-bit or 8-bit depending on the user-selected firmware option. Signals are pulled-down. LVTTL 0 – 3.3V
WAN_RX_DATA_ VALID_IN	Input data enable. Read the input data at the rising edge of CLK_IN when VALID = '1'. Signal is pulled-down. LVTTL 0 – 3.3V
WAN_RX_CTS _OUT	Input flow control signal (output). '1' indicates that the COM-5404 is ready to accept DATA_IN input samples into its input elastic buffer. LVTTL 0 – 3.3V. Signal is pulled-down.
WAN_RX_CLK_IN	Input reference clock for synchronous I/O. DATA_IN and VALID_IN are read at the rising edge of CLK_IN. Maximum frequency: 125 MHz. LVTTL 0 – 3.3V

Output Signals	Definition
WAN_TX_DATA _OUT[7:0]	Output data to the WAN. The data width can be 1-bit or 8-bit depending on the user-selected firmware option. LVTTL 0 – 3.3V
WAN_TX_DATA_ VALID_OUT	Output data enable. The receiving end should read data at the rising edge of CLK_OUT when VALID = '1'. LVTTL 0 – 3.3V
WAN_TX_CTS _IN	Input flow control signal (output). LVTTL 0 – 3.3V. Signal is pulled-up
WAN_TX_CLK_OUT	LVTTL 0 – 3.3V 125 MHz output reference clock. (from internal oscillator).

Other Interfaces	Definition
LAN	10/100/1000 Mbits/s Ethernet LAN. RJ45 connector
USB	USB 2.0 Use USB 2.0 approved cable for connection to a host computer. Maximum recommended cable length is 3'. The USB connection is needed only for a one-time initial static IP configuration.

Initial Configuration

Before the first use, the router must be assigned a static IP address over LAN, USB or through adjacent ComBlocks by following the one-time procedure below:

Step 1a (LAN): The COM-5404 is shipped with a static IP address: 172.16.1.128. The easiest way to perform the first configuration is to configure a PC with an address on the 172.16.1.x subnet, or

Step 1b (USB): Connect a short USB cable between the COM-5404 and a PC. When using ComBlocks for the first time, the PC will ask for a USB driver. Just follow the instructions and point to the driver located in the ComBlock CD-ROM folder entitled "\Windows Drivers\USB 2.0\Windows Driver". Point to the proper folder for Windows 7 and below, or Windows 8 and above.

Step 2:

a) Start the ComBlock Control Center, click on the *Communication parameters setup* button  and select USB as the primary communication channel.

b) In the ComBlock Control Center window detect the ComBlock module(s) by clicking the  *Detect* button, next click to highlight the COM-5404 module, then click the  *Settings* button.

Step 3:

c) Enter a static IP address in the LAN section. The IP address must be unique and must be consistent with your LAN (i.e. the first two or three numbers of the router IP address match the first two or three numbers of your computer's IP address).

This procedure is a one-time procedure required before the first use. Once the router IP address is saved in non-volatile memory, the ComBlock Control Center can communicate with the COM-5404 over the LAN.

Configuration

An entire ComBlock assembly comprising several ComBlock modules can be monitored and controlled centrally over a single connection with a host computer. Connection types include built-in types:

- TCP-IP/LAN,
- USB

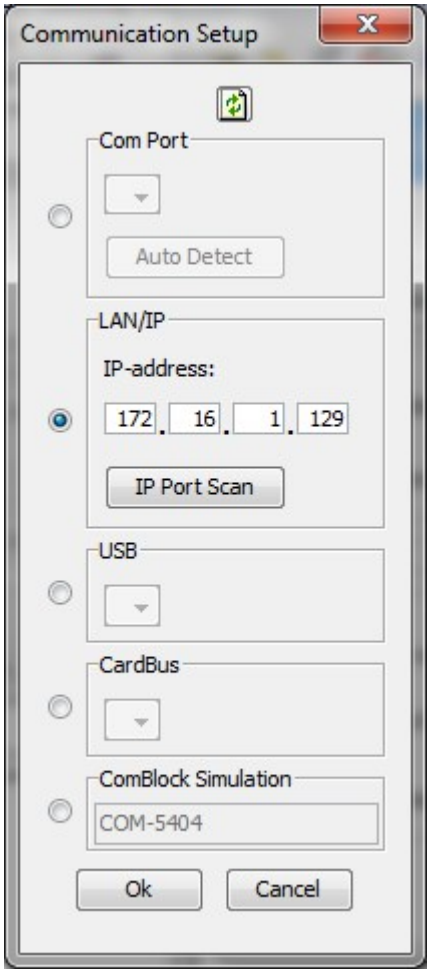
or connections via adjacent ComBlocks.

The module configuration is stored in non-volatile memory.

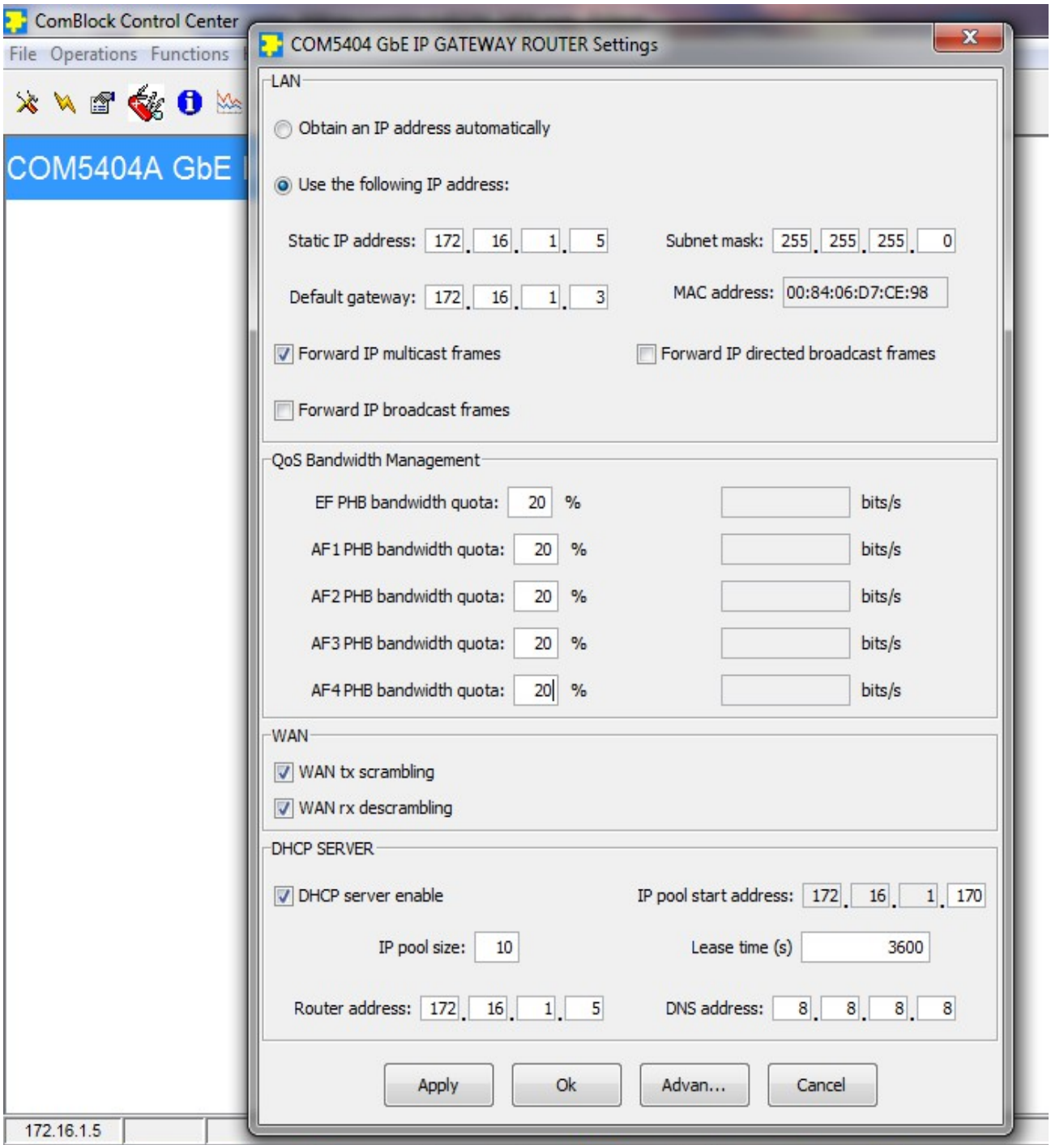
Configuration (Basic)

The easiest way to configure the COM-5404 is to use the **ComBlock Control Center** software supplied with the module on CD.

Start the ComBlock Control Center, click on the *Communication parameters setup* button  and select LAN/IP as the primary communication channel. Enter the COM-5404 IP address as previously defined.


Communication Setup
Com Port
Auto Detect
LAN/IP
IP-address:
172 . 16 . 1 . 129
IP Port Scan
USB
CardBus
ComBlock Simulation
COM-5404
Ok
Cancel

Then detect the ComBlock module(s) by clicking the *Detect* button, next click to highlight the COM-5404 module to be configured, next click the *Settings* button to display the *Settings* window shown below:



Configuration (Advanced)

Alternatively, users can access the full set of configuration features by specifying 8-bit control registers as listed below. These control registers can be set manually through the ComBlock Control Center or by software using the ComBlock API (see www.comblock.com/download/M&C_reference.pdf)

All control registers are read/write. Definitions for the Control registers and Status registers are provided below.

Control Registers

The module configuration parameters are stored in volatile (SRT command) or non-volatile memory (GUI or SRG command).

Parameters	Configuration
LAN	
Obtain an IP address automatically (DHCP client enabled within)	'1' when this device IP configuration (IP address, subnet mask, default gateway) is obtained automatically from an external DHCP server. '0' when these parameters are static and user-defined below. REG20(1)
This router requested IP address	This router's own IP address. It is either a user-defined static address or, when the DHCP client is enabled, a requested IP address. In the latter case, a DHCP server will automatically assign the IP address which may or may not be the same as the requested address. Check status registers SREG16-19 for the actual IP address. Other local IP nodes must be told of this router IP address (usually referred to as "Default gateway" in the Internet Protocol properties control panel). Format example : 0x AC 10 01 80 designates address 172.16.1.128 REG0 (MSB) – REG3 (LSB)
Subnet mask	4-byte subnet mask has two purposes: (a) Helps the COM-5404 IP router distinguish between local IP destinations within this subnet and remote destinations. Example : 0x FF FF FF 00 designates IP subnet mask 255.255.255.0. (b) inform DHCP clients about the subnet size.
	It is either a user-defined field or, when the DHCP client is enabled, assigned automatically. REG4 (MSB) – REG7 (LSB)
Default gateway	The router will forward IP frames from the WAN to this gateway when the destination IP address is not local. It is either a user-defined static address or, when the DHCP client is enabled, assigned automatically. REG8 (MSB) - REG11(LSB)
IP multicast enable	IP multicast addresses are intended to reach an arbitrary subset of the hosts on a local network. Destination addresses are in the range 224.0.0.0 to 239.255.255.255. 0 = disable forwarding of IP multicast IP frames 1 = enable forwarding of IP multicast IP frames REG12(5)
Directed IP broadcast enable	Directed broadcast IP frames are those packets with IP destination address in the form (Network prefix, 255). For example 172.16.255.255 or 172.16.1.255. IP directed broadcast frames should generally be dropped for security reasons (for example to reduce the risk of DoS attacks). 0 = disable forwarding of directed broadcast IP frames 1 = enable forwarding of directed broadcast IP frames REG12(6)
IP broadcast forwarding enable	IP broadcast frames (those with destination IP address 255.255.255.255) should generally not be forwarded unless specifically authorized below: 0 = disable forwarding of broadcast IP frames 1 = enable forwarding of broadcast IP frames REG12(7)
PRBS11 test sequence	Transmit a 2047-bit pseudo-random test sequence to test the WAN transmit interface. (Place a bit error rate tester at the WAN receiving end). REG12(4) Enable(1)/disable(0)

QoS bandwidth management LAN -> WAN IP forwarding	
EF PHB bandwidth quota (%)	Differentiated Services configuration: Percentage of the overall LAN-to-WAN transmit bandwidth allocated to the Expedited Forwarding (EF). Expressed as percentage: 128 represents 100%. REG14
AF1 PHB bandwidth quota (%)	Differentiated Services configuration: Percentage of the overall LAN-to-WAN transmit bandwidth allocated to the Assured Forwarding class 1 (AF1). Expressed as percentage: 128 represents 100%. REG15
AF2 PHB bandwidth quota (%)	Differentiated Services configuration: Percentage of the overall LAN-to-WAN transmit bandwidth allocated to the Assured Forwarding class 2 (AF2). Expressed as percentage: 128 represents 100%. REG16
AF3 PHB bandwidth quota (%)	Differentiated Services configuration: Percentage of the overall LAN-to-WAN transmit bandwidth allocated to the Assured Forwarding class 3 (AF3). Expressed as percentage: 128 represents 100%. REG17
AF4 PHB bandwidth quota (%)	Differentiated Services configuration: Percentage of the overall LAN-to-WAN transmit bandwidth allocated to the Assured Forwarding class 4 (AF4). Expressed as percentage: 128 represents 100%. REG18
WAN configuration	
Scrambling enable	Enable (1) or disable (0) the V.35 scrambler used on the 1-bit serial link when forwarding IP frames to the WAN. This self-synchronizing scrambling's objective is to randomize the bit stream and avoid the short repetitive and unbalanced pattern of 0x7E empty frames inherent with the use of HDLC framing. Enable to prevent confusion at Viterbi FEC decoders and demodulators bit timing loops. REG12(0)
Descrambling enable	Enable (1) or disable (0) the V.35 descrambler used on the 1-bit serial link, when receiving IP frames from the WAN. REG13(0)

DHCP server configuration	
DHCP server enable	Enable (1) or disable (0) the built-in DHCP server. Note: this DHCP server requires a static IP address (i.e. the DHCP client must be disabled) REG20(0)
IP pool size	Maximum number of consecutive IPv4 addresses that the DHCP server is allowed to assign to DHCP clients. REG21
IP pool starting address	The DHCP server will assign DHCP clients IPv4 addresses from a range starting at this base address. This base address is only identified by its LSB. The most significant address bytes are those of this device. REG25: LSB
Lease time	IP address lease time to DHCP clients, in seconds. Typically 86400 s (1 day) REG26 (LSB) – REG29 (MSB)
DNS address	The DHCP server tells clients about one possible DNS to use. For example 08.08.08.08 for Google DNS. REG30 (MSB) – REG33 (LSB)
Default gateway	The DHCP server tells clients about the default gateway. Typically points to this device to use the WAN but could point to another gateway. REG34 (MSB) – REG37 (LSB)
MAC address	
LAN MAC address LSB	REG236. To ensure uniqueness of MAC address. The MAC address most significant bytes are tied to the FPGA DNA ID. However, since Xilinx cannot guarantee the DNA ID uniqueness, this register can be set at the time of manufacturing to ensure uniqueness. This byte is not overwritten when importing configuration data.

Most changes are enacted immediately upon (re-)writing to the last control register REG44, without a need to reset the module.

Options

Some configuration parameters are not selectable dynamically at run-time, but selected by enabling one of several FPGA firmware options. All firmware options are freely downloadable from www.comblock.com/download.

Changing the functionality may require loading the firmware once using the ComBlock control center ( button) if it is not already loaded. Then switching between the stored firmware options The selected firmware option is automatically reloaded at power up or upon software command within 1.2 seconds

Option	Definition
-A	1-bit serial WAN interface, right connector J8
-C	8-bit parallel WAN interface right connector J8
-E	1-bit serial WAN interface, left connector J4
-F	8-bit parallel WAN interface left connector J4

Monitoring

Status Registers

Parameters	Monitoring
Hardware self-check	At power-up, the hardware platform performs a quick self check. The result is stored in status registers SREG0-9 Properly operating hardware will result in the following sequence being displayed: SREG0-8 = 01 F1 1D 00 1F 93 10 22 07
MAC address	Unique 48-bit hardware address (802.3). SREG10 (MSB) – SREG15 (LSB)
IP address	Actual IPv4 address (whether static IP or automatically assigned) SREG16(MSB) - SREG19(LSB)
Subnet mask	Actual subnet mask (whether static or automatically assigned) SREG20(MSB) - SREG23(LSB)
Default gateway IP address	Actual default gateway IP address (whether static IP or automatically assigned) SREG24(MSB) - SREG27(LSB)
Number of transmitted bytes (LAN to WAN)	Cumulative number of IP frames bytes sent in the LAN to WAN direction. Excludes HDLC framing overhead and empty HDLC frames. 32-bit byte count. Counter rolls over when reaching 0xFFFFFFFF.

	SREG28 (LSB) – SREG31 (MSB)
Number of received bytes (WAN to LAN)	Cumulative number of IP frames bytes received in the WAN to LAN direction. Excludes HDLC framing overhead and empty HDLC frames. 32-bit byte count. Counter rolls over when reaching 0xFFFFFFFF. SREG32 (LSB) – SREG35 (MSB)
Erroneous IP frames	A measure of the link quality is the number of IP frames lost during transmission. Cumulative number of IP frames received on the WAN side with bad CRC and subsequently dropped. 32-bit byte count. Counter rolls over when reaching 0xFFFFFFFF. SREG36 (LSB) – SREG39 (MSB)
WAN transmit bit rate	WAN transmit bit rate expressed as number of bytes in a 100ms window. SREG40 (LSB) – SREG43(2:0) (MSB)
DHCP server monitoring	Monitoring key DHCP server counters: SREG44: received DHCPDISCOVER SREG45: received DHCPREQUEST addressed to this server (continuation of the DHCPDISCOVER) SREG46: received DHCPREQUEST (renewing state) SREG47: received DHCPREQUEST (init reboot state) SREG48: sent DHCPACK messages, concluding successful dynamic IP address assignments. The counters above are modulo 256.
Gateway presence detected	1 = gateway responded to ARP requests 0 = no response from specified gateway SREG49(0)
BER tester synchronized	1 = when detected a PRBS11 test sequence from the WAN 0 = BER tester is not synchronized SREG50(0)
BER	Bit Errors over a 1MByte window. Valid only when BER tester is synchronized.

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 status register SREG7. Therefore, status register 7 should always be read first.

Digital Test Points

These test points on the J8 connector (top side) are designed for real-time monitoring using an oscilloscope probe. The main focus of these test points is to help monitor proper data flow.

Test Point	Definition
LAN to WAN direction	
J8.A29	Incoming Ethernet LAN data packet (not necessarily an IP frame) Timescale: 8 ns per byte.
J8.A30	IP forwarding pulse. High at the end of the frame when all IP forwarding criteria are met: IP frame, remote IP destination, no congestion in the class queue, etc.
J8.A31	Forwarding IP frame to WAN. Frame is HDLC encoded. Timescale: 8 ns per bit or byte (depending on WAN interface data width)
J8.A32	IP forwarding Differentiated Services congestion: at least one queue is full.
WAN to LAN direction	
J8.A33	Receiving HDLC encoded IP frame from WAN.
J8.A34	0x7E flag marking the start and end of HDLC encoded frames.
J8.A35	Bad CRC16 in HDLC frame received from the WAN. The frame is discarded.
J8.A36	No routing information available in the routing table, no ARP reply from the target. The packet is discarded.
J8.A37	Receiver buffer overflow condition. The packet is discarded.
J8.A36	BER tester is synchronized with the PRBS11 test sequence received from the WAN
J8.A37	BER tester matched filter output (detects start of PRBS11 sequence)
J8.A38	IP router sending IP frame to Ethernet LAN. Timescale: 8ns per byte.
DONE	1 when the FPGA is loaded with a valid .bit configuration file. The COM-5404 is operational typically 1.2 seconds after power up.

These test points can be placed in high-impedance by setting control register REG44(0) to '0'.

Principle of operation

Concept

The COM-5404 forwards IP frames from a RJ-45 10/100/1000 Mbps LAN interface to a clock-synchronous modem interface and vice versa. The interface can be 1-bit serial or 8-bit parallel.

The IP frames received over the LAN are stripped of their link layer information: Ethernet source address, destination address and type are removed, keeping only the IP fields.

TCP, UDP, ICMP and IGMP packets are processed since they are transmitted as IP frames.

Non IP frames are rejected.

IP frames whose Time-To-Live field has reached zero are discarded. For the other packets, the TTL is decremented.

The COM-5404 implements Differentiated Services (DiffServ) whereby IP forwarding from LAN to WAN is prioritized on the basis of the IP frame DSCP field. Five queues handle different traffic classes, including Expedited Forwarding (EF) for low-loss, low-latency, low-jitter frames and four Assured Forwarding (AF1-AF4) classes. Frames are discarded without notification if the associated queue is full.

The IP frame maximum size (maximum transmission unit (MTU)) is 1500 bytes. No datagram fragmentation is necessary nor used.

The IP frames are then encapsulated within a bit-serial or byte-wise HDLC frame, one packet per frame. A 16-bit CRC is inserted at the end of each frame to detect errors upon reception. HDLC encoding transmits empty frames when no payload data is available.

Bit-serial HDLC frames can be subsequently scrambled with a V.35 scrambler to ensure balance between 0's and 1's and guarantee bit transitions (for a well behaved modulated spectrum and to assist demodulator acquisition when applicable).

The resulting stream is then sent to the WAN over a continuous link, typically using a modem.

The reverse process is performed at the receiving end. Erroneous packets which do not pass the CRC test are rejected.

IP forwarding (LAN-TO-WAN)

The forwarding rules are specified in the RFC1812 document “Requirements for IP Version 4 Routers”.

The decision to forward a LAN IP frame to the remote WAN is based solely on the destination IP address. To determine whether a frame is destined to a local (LAN) or remote (WAN) IP address, the router compares the masked destination address (Destination IP address & subnet mask) with the masked router address
(IP router own IP address & subnet mask). When this comparison is false, the IP frame is forwarded to the WAN.

Example:

- Router IP address: 192.68.0.2
- Router subnet mask: 255.255.255.0
- Frame destination IP address is 74.54.97.66

Masked frame destination: 74.54.97.0
Masked router address: 192.68.0.0
Since the masked destination does not match the masked router address, the frame is not for a local destination. Consequently the router will forward the frame to the WAN.

IP broadcast frames (those with destination IP address 255.255.255.255) are not forwarded unless specifically authorized.

IP unicast frames

Differentiated services

The router also prioritizes IP forwarding based on the IP header differentiated services code point (DSCP).

A forwarded IP frame is sent to one of five queues depending on its DSCP:

One queue is reserved for low-loss, low-latency, low-jitter, and assured bandwidth service. It is associated with “Expedited Forwarding” (EF) per-hop behavior.
The recommended DSCP value for EF is `101110' (see RFC-2474)

Four other queues are associated with “Assured Forwarding” per-hop behavior (see RFC-2597)

Users can select the link bandwidth apportionment among the five queues through the graphical user interface.

IP routing (WAN-TO-LAN)

The stream received over the link undergoes V.35 descrambling and HDLC decoding to reconstruct IP frames. Erroneous frames which do not pass the CRC test are rejected.

Valid IP frames are re-encapsulated inside an Ethernet packet, one IP frame per Ethernet packet.

The IP address – MAC address relationships are stored within a routing table to expedite the Ethernet packet construction. The routing table includes up to 512 local IP addresses, with associated 48-bit MAC address and 'freshness' stamp.

When the routing table has no information regarding the destination IP address, it will attempt to find out by means of an Address Resolution Protocol (ARP) query-reply transaction. The router will broadcast an ARP request asking “whois the destination IP address?” and will wait for the ARP reply with the MAC information.

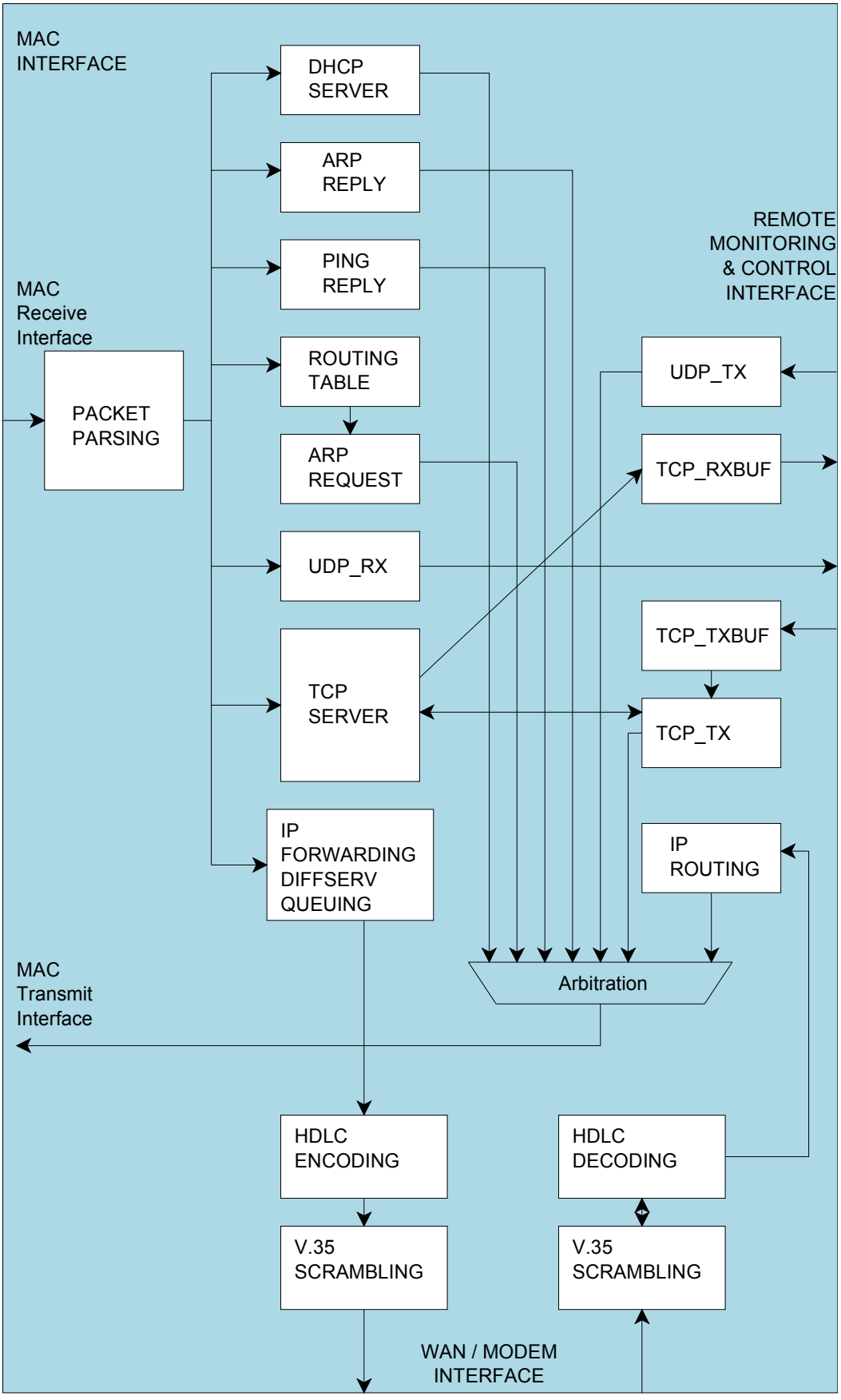
Co-located DHCP server

A built-in DHCP server automatically assigns IP addresses to local IP clients, for ease of network management. The addresses are taken from a pool of contiguous IP addresses and leased for a limited time.

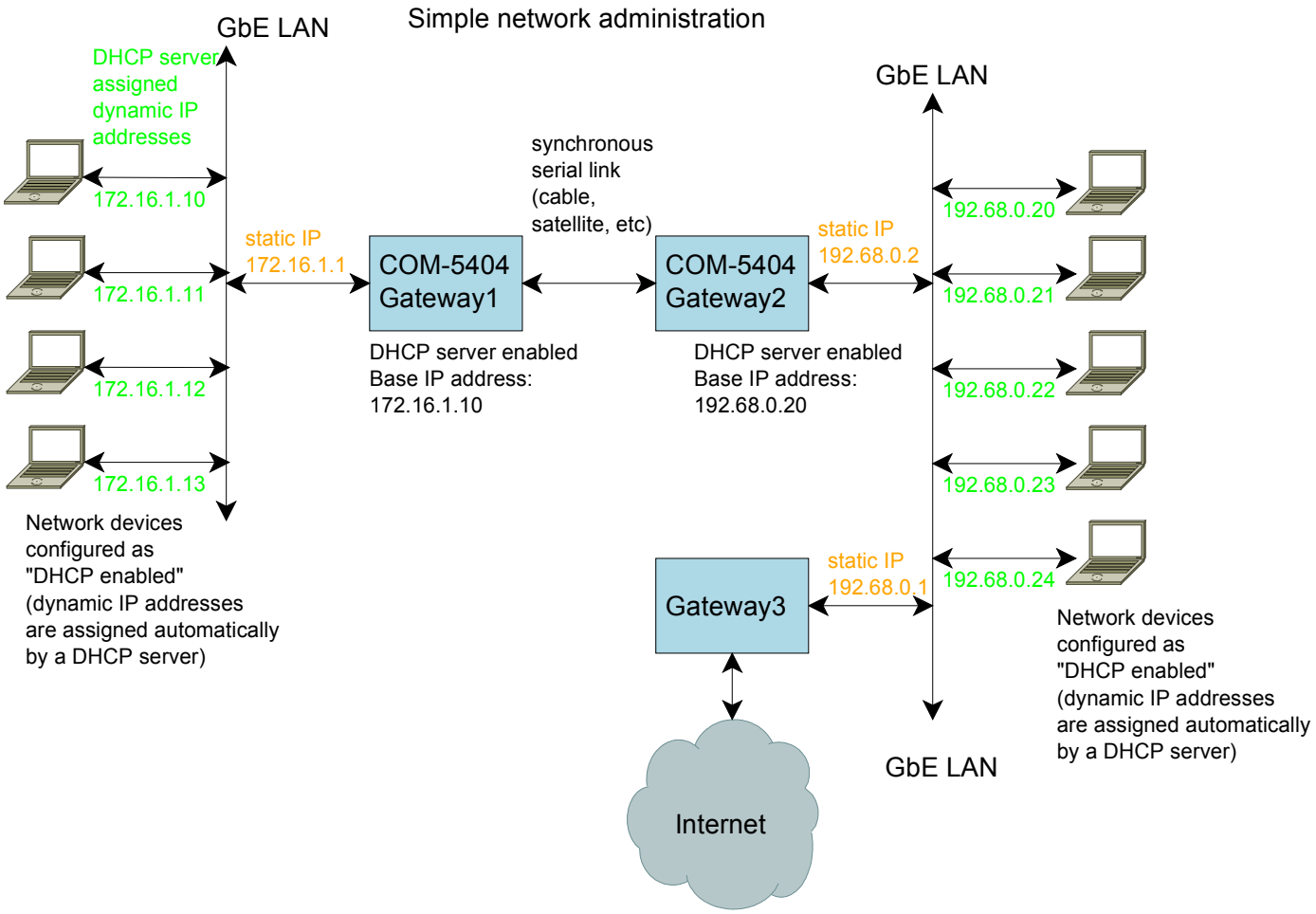
In addition to assigning IP addresses, the DHCP server informs clients about important network management parameters such as gateway and DNS.

Co-located DHCP client

When enabled, the built-in DHCP client automatically fetches an IP address for this device. In most use cases, use of the DHCP client is mutually exclusive with use of the DHCP server.

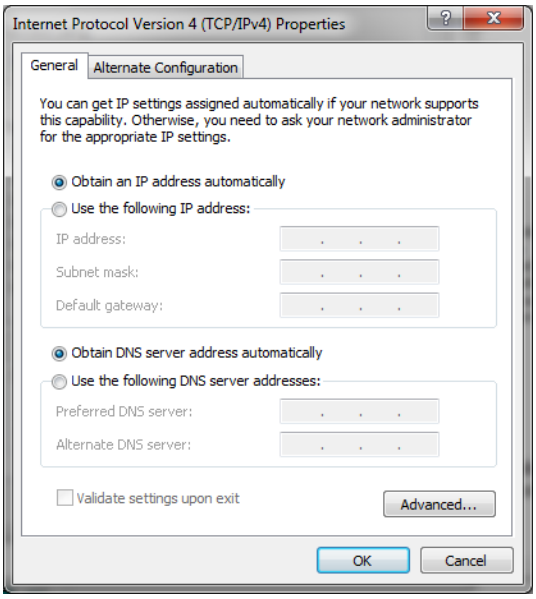

MAC
INTERFACE
DHCP
SERVER
ARP
REPLY
PING
REPLY
REMOTE
MONITORING
& CONTROL
INTERFACE
MAC
Receive
Interface
ROUTING
TABLE
UDP_TX
PACKET
PARSING
ARP
REQUEST
TCP_RXBUF
UDP_RX
TCP_TXBUF
TCP
SERVER
TCP_TX
IP
FORWARDING
DIFFSERV
QUEUING
IP
ROUTING
MAC
Transmit
Interface
Arbitration
HDLC
ENCODING
HDLC
DECODING
V.35
SCRAMBLING
V.35
SCRAMBLING
WAN / MODEM
INTERFACE
140005

Network Administration



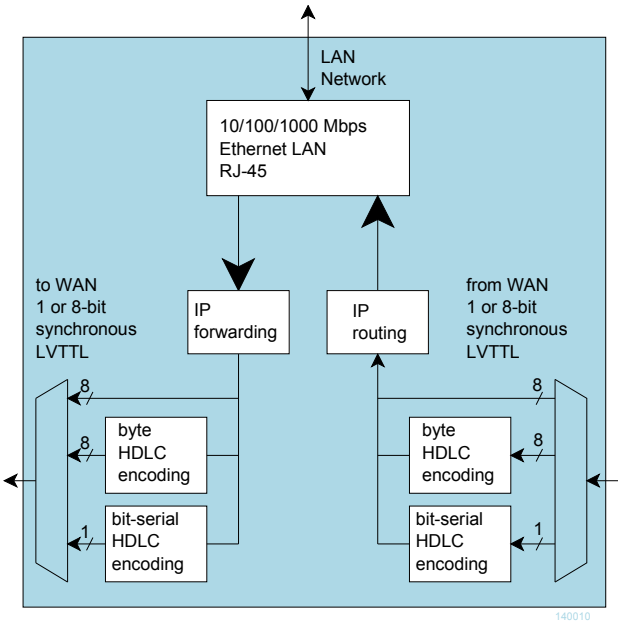
The diagram above illustrates a simple network administration scheme, whereby only gateways are administered with fixed (static) IP addresses. The other network devices automatically fetch their network configuration (IP address, subnet mask, DNS) from a DHCP server, like the one in the COM-5404.

For example, a PC running Microsoft's Windows operating system would be configured as per the right panel:



LVTTL I/O Format

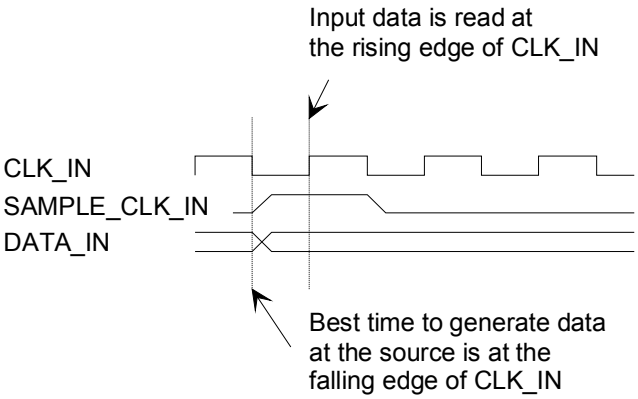
The user can select among several formats (8-bit parallel mode or 1-bit serial) for the input and output connectors through control registers.



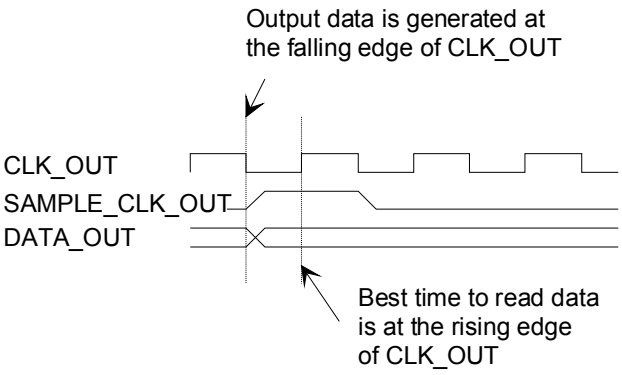
I/O Format

Timing for the LVTTL interface is shown below:

Input



Output



Serial HDLC

A bit-serial HDLC format can be used to convey data over a synchronous bit-serial link such as a wireless or satellite link. The HDLC objective is three-fold:

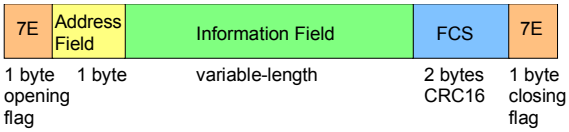
(α) Tell the receiver side when no information is available for transmission (sending empty frames).

(β) Implement multiple virtual channels over a common physical link (unused feature here)

(χ) Recover the original bit-to-byte alignment of the original byte data stream.

Serial HDLC format

This section provides details as to the serial HDLC format used on the synchronous serial link. It is intended for developers and can be skipped by most users.



Data is encapsulated within variable length frames starting and ending with a 0x7E flag. A two-byte CRC check can be used to verify if the frame is error free. A frame encapsulates a single IP frame.

The information field always contains an integer number of bytes. The most significant bit is transmitted first.

The maximal frame length (before accounting for bit stuffing) is 1500 bytes of information (IP MTU) plus 5 bytes of overhead.
The following bit-stuffing mechanism is used on the transmit side for all fields except the opening and closing flags: a '0' is inserted after five consecutive 1's.

The address field is used to indicate the type of data conveyed within. The current implementation uses only a single virtual channel 01.

Byte HDLC format

This section provides details of the byte HDLC encapsulation method used on the synchronous 8-

bit parallel data link. It is intended for developers and can be skipped by most users.

TBD

Recovery

The COM-5404 is protected against corruption by an invalid FPGA configuration file or an invalid user configuration. To recover from such occurrence, connect a jumper in JP1 position 2-3 prior and during power-up. This prevents the FPGA configuration. Keep the jumper at least 2 seconds after power up, then remove it. Keep the power on. This will restore USB communications with the ComBlock Control Center through the J2 DEV USB port. Once this is done, the user can safely restore the user configuration and/or re-load a valid FPGA configuration file into flash memory using the ComBlock Control Center GUI.

TCP-IP for remote M&C

Remote monitoring and control of this device is possible through a TCP connection to port 1028. The device acts as a TCP server, listening for a connection from a remote client such as the ComBlock Control Center software.

Ping

The module responds to ping requests with size up to 470 bytes. Ping can be used to check the module response over the LAN network. Ping can be used at any time, concurrently with other transmit and receive transactions. For example, on a Windows operating system, open the Command prompt window and type "ping –t –l 470 172.16.1.128" to send pings forever of length 470 bytes to address 172.16.1.128.

Power Up

The LAN link is available 2.05 seconds after power up.

LEDs

2 LEDs within the LAN RJ-45 jack provide summary information as to the LAN: Link, activity and negotiated speed.

Link/Activity	LED2 (left) Green	LED1 (right) Yellow
Link off	Off	Off
1000 Link / no activity	On	Off
1000 Link / activity	Blinking	Off
100 Link / no activity	Off	On
100 Link / activity	Off	Blinking
10 Link / no activity	On	On
10.Link / activity	Blinking	Blinking

Schematics

The board schematics are available on-line at
http://comblock.com/download/com_1800schematics.pdf

Operating input voltage range

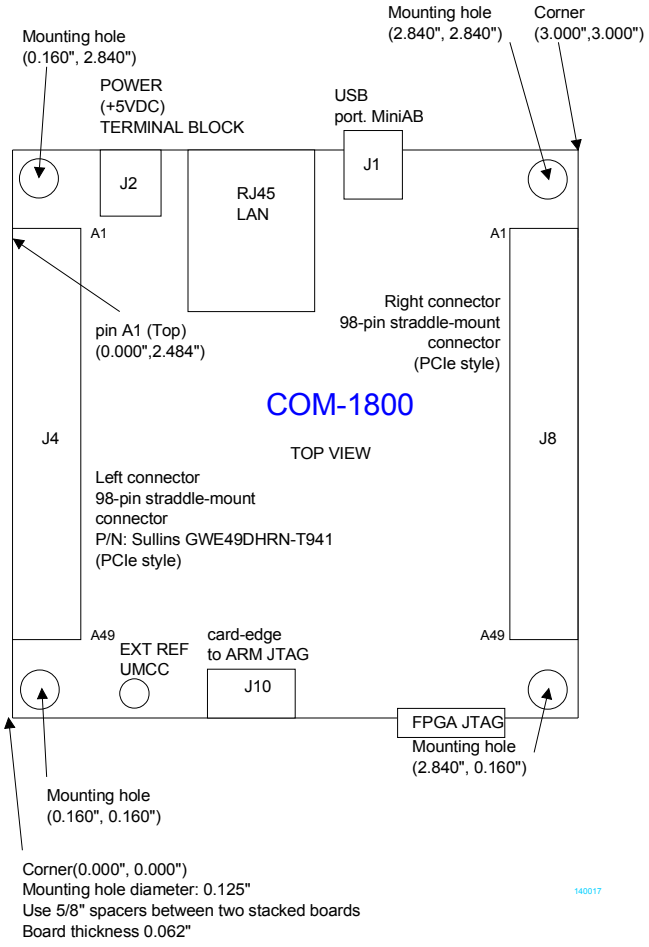
Supply voltage	+4.5V min, +12V max 650mA typ.

Absolute Maximum Ratings

Supply voltage	-0.5V min, +20V max
98-pin connector inputs	-0.5V min, +3.6V max

Important:
The I/O signals connected directly to the FPGA are NOT 5V tolerant!

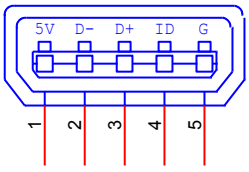
Mechanical Interface



Pinout

USB Connectors

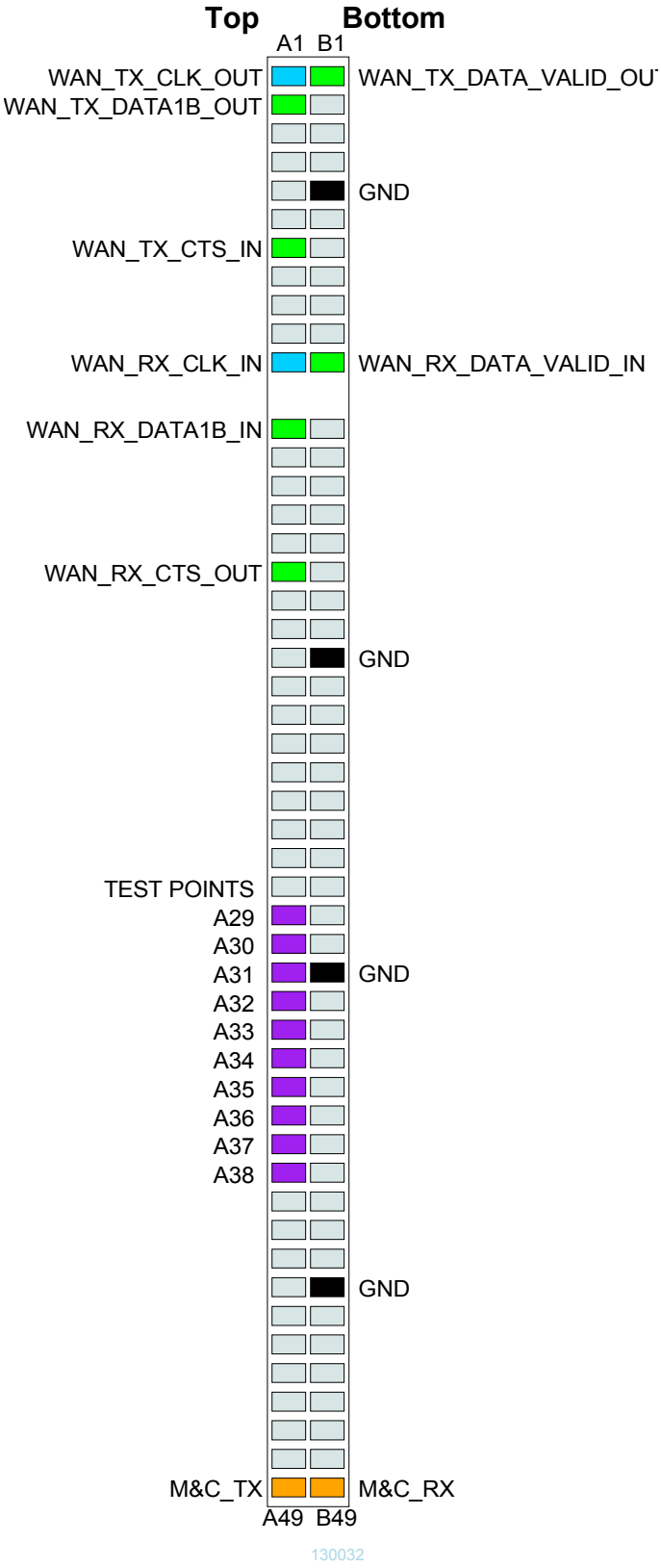
Both USB ports are equipped with mini type AB connectors. (G = GND). In both cases, the COM-1524 acts as a USB device.



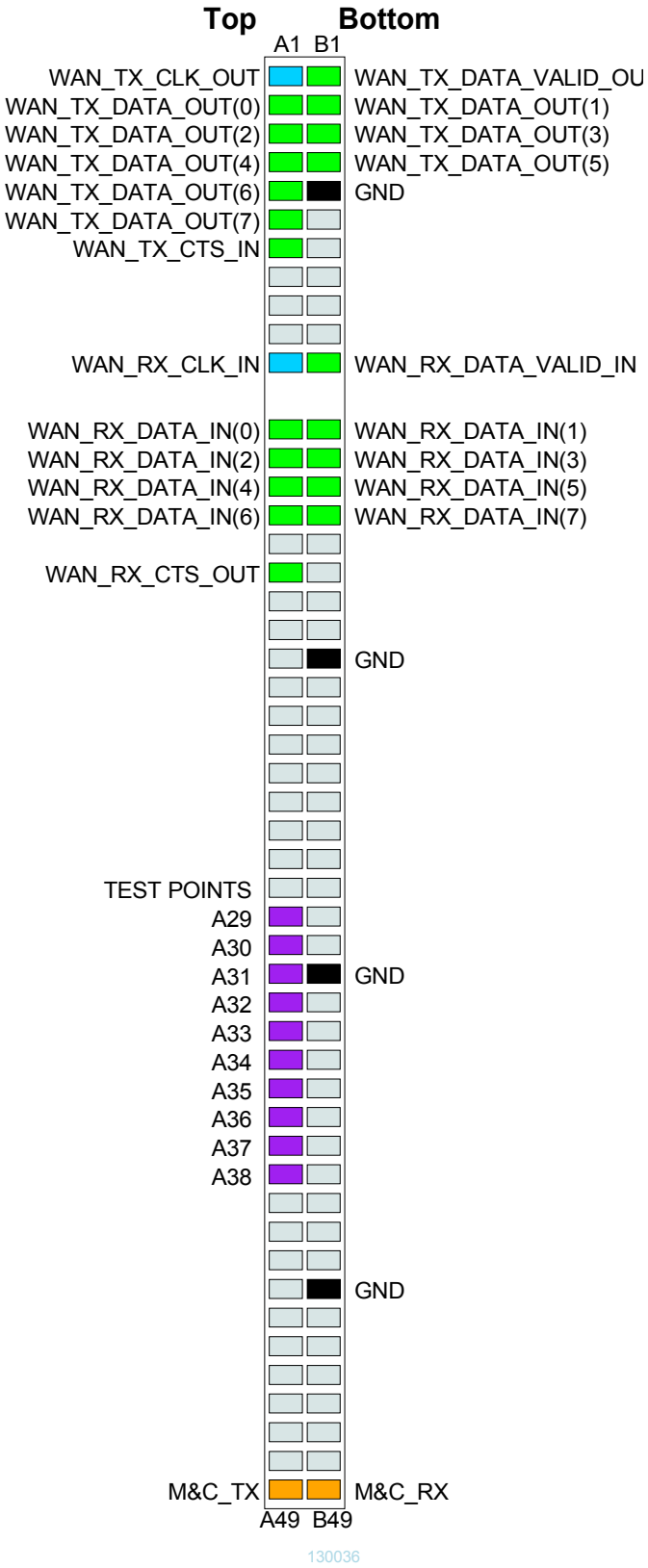
LAN Connector RJ1

The RJ-45 Jack is shielded with top and side ground taps. It supports MDIX and can therefore be connected directly to a PC or a LAN switch using Cat 5 cable. There is no need for crossover cable.

Right Connector J8

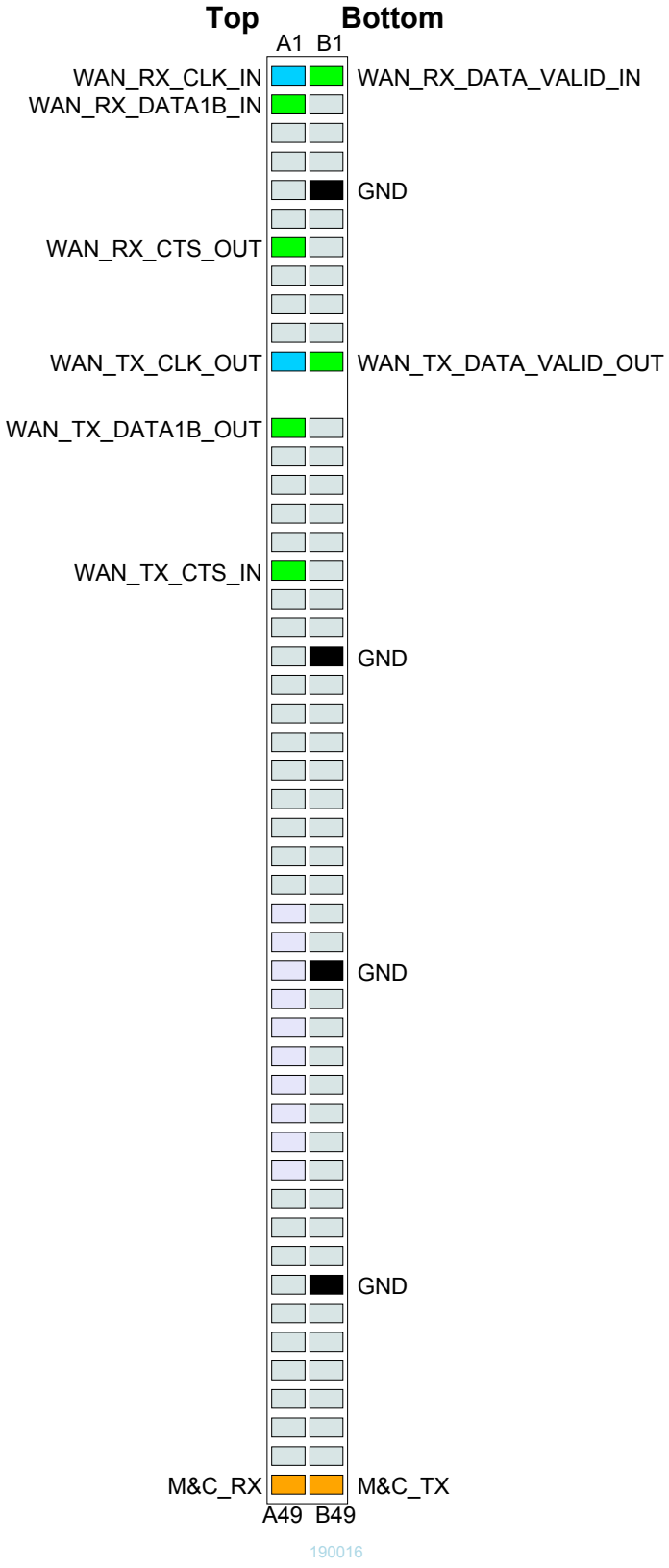


Configured as 1-bit synchronous serial interface
firmware option **-A**

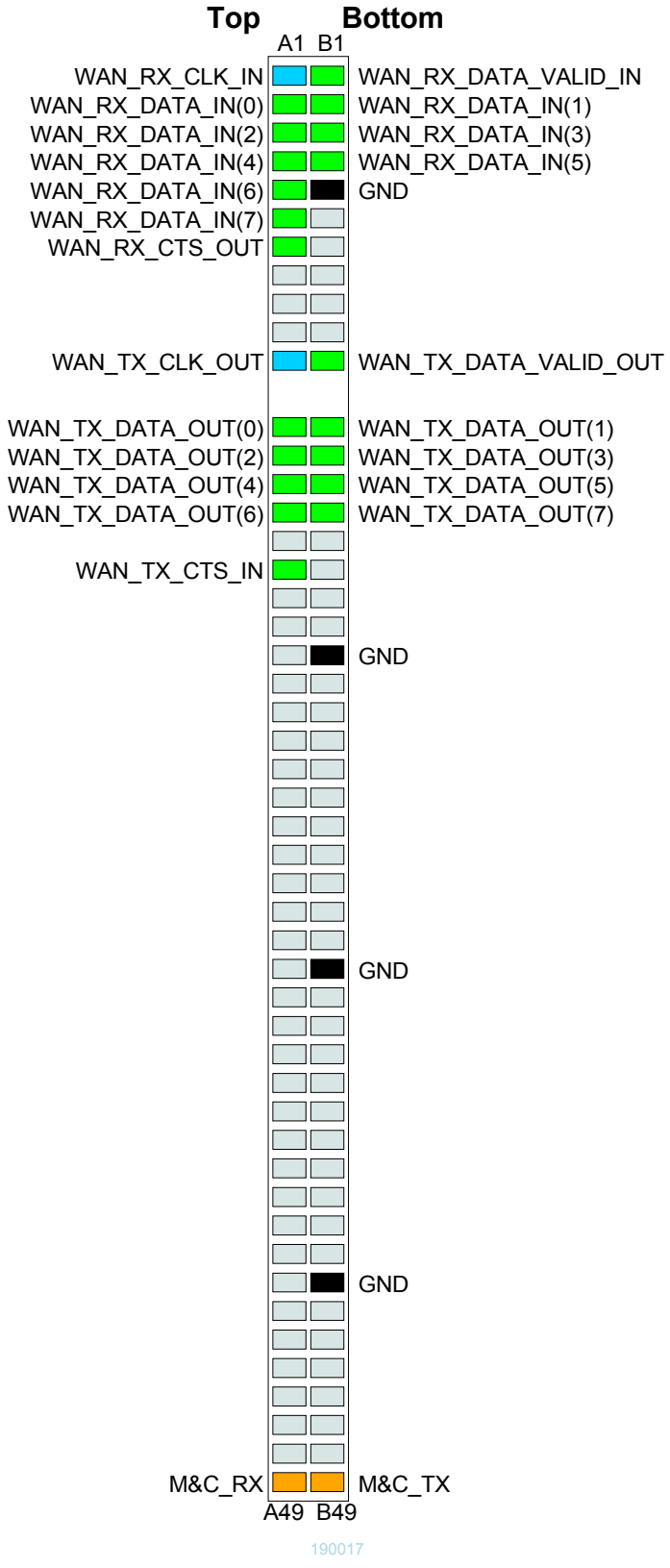


Configured as 8-bit parallel synchronous interface
firmware option **-C**

Left Connector J4



Configured as 1-bit synchronous serial interface
firmware option **-E**



Configured as 8-bit parallel synchronous interface
firmware option **-F**

I/O Compatibility List

(not an exhaustive list)

COM-1800 FPGA + ARM development platforms
COM-1805 Continuous-mode PSK digital modem (BPSK,QPSK,OQPSK)

Configuration Management

This specification is to be used in conjunction with VHDL software revision 7 and ComBlock Control Center revision 3.13 and above.

Acronyms

DNS	Domain Name Server
IP	Internet protocol
LAN	Local Area Network
LSB	Least Significant Byte
MSB	Most Significant Byte
WAN	Wide Area Network

ComBlock Ordering Information

COM-5404 GbE IP Gateway Router

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