MITS JANUS TIME ENGINE
PART NUMBER 1700264
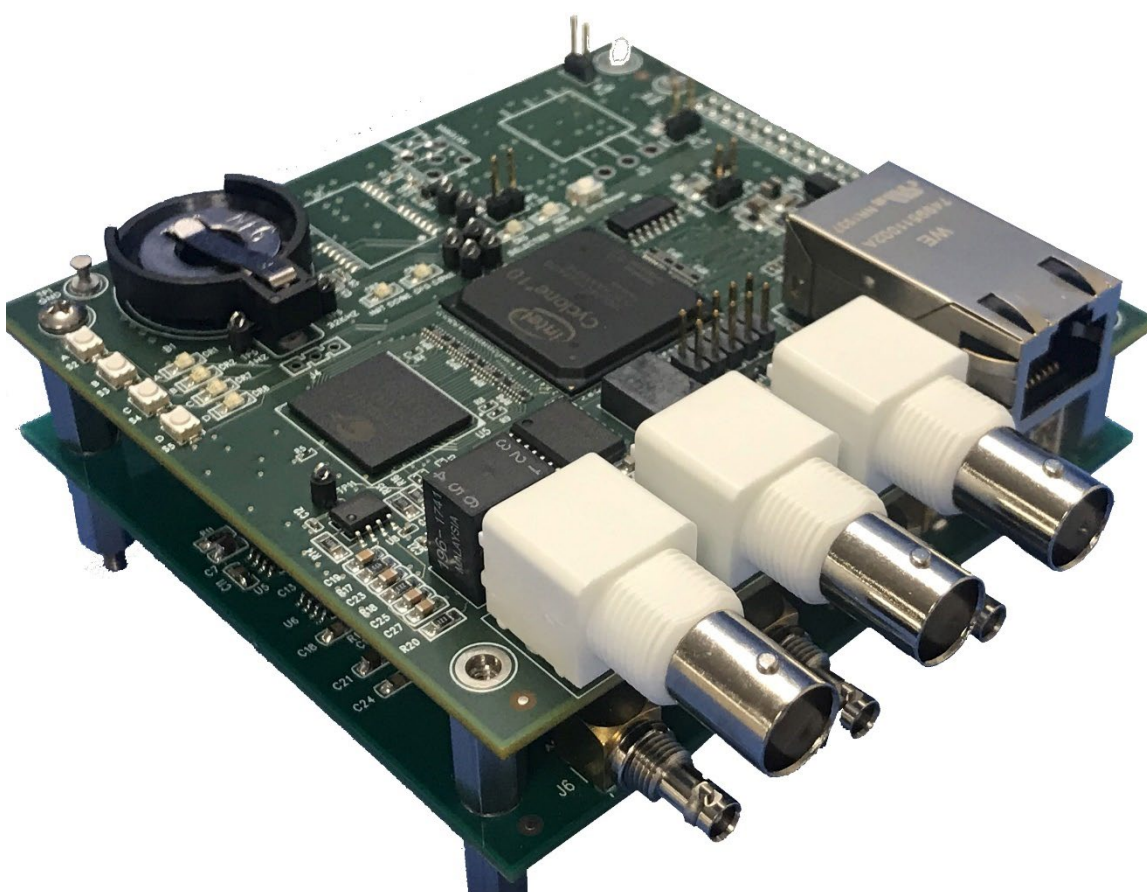
June 15, 2022

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CHANGE HISTORY

Release Date	Change
6/1/2020	Preproduction Release
6/9/2020	Modified commands per Engineering inputs; added return responses to queries.
6/25/2020	Production Release
9/25/2020	Updated the PTP Master commands, ^Y??x (two places as PTP mode and PTP Master settings). Expanded the introduction to the Webserver to explain when updates are suspended by the user mouse pointer. Added IRIG prop delay controls and Manual leap second input.
10/5/2020	Updated the start up behavior in paragraph 1.1.8 Ethernet.
11/10/2020	Added ^T? command to query the current time including the year.

1.0 GENERAL DESCRIPTION

The MITS Janus Time Engine (MJTE) consists of a two-board set compliant with the physical dimensions of the PC104 standard.

1. The Janus Time Engine Master Controller (JTEMC), part number 1412413
2. Photo-Sonics Interface (PSI/O), part number 1412414

There is a stack interface connector between the two boards. This interface is not compliant with the PC104 specification and may not be used as part of a PC104 stack.

The GigE interface present on the JTEMC is the interface used to control and receive status from the MJTE. Similarly, it provides the control and status for the embedded webserver functions.

A block diagram of the aggregate MJTE is shown below.
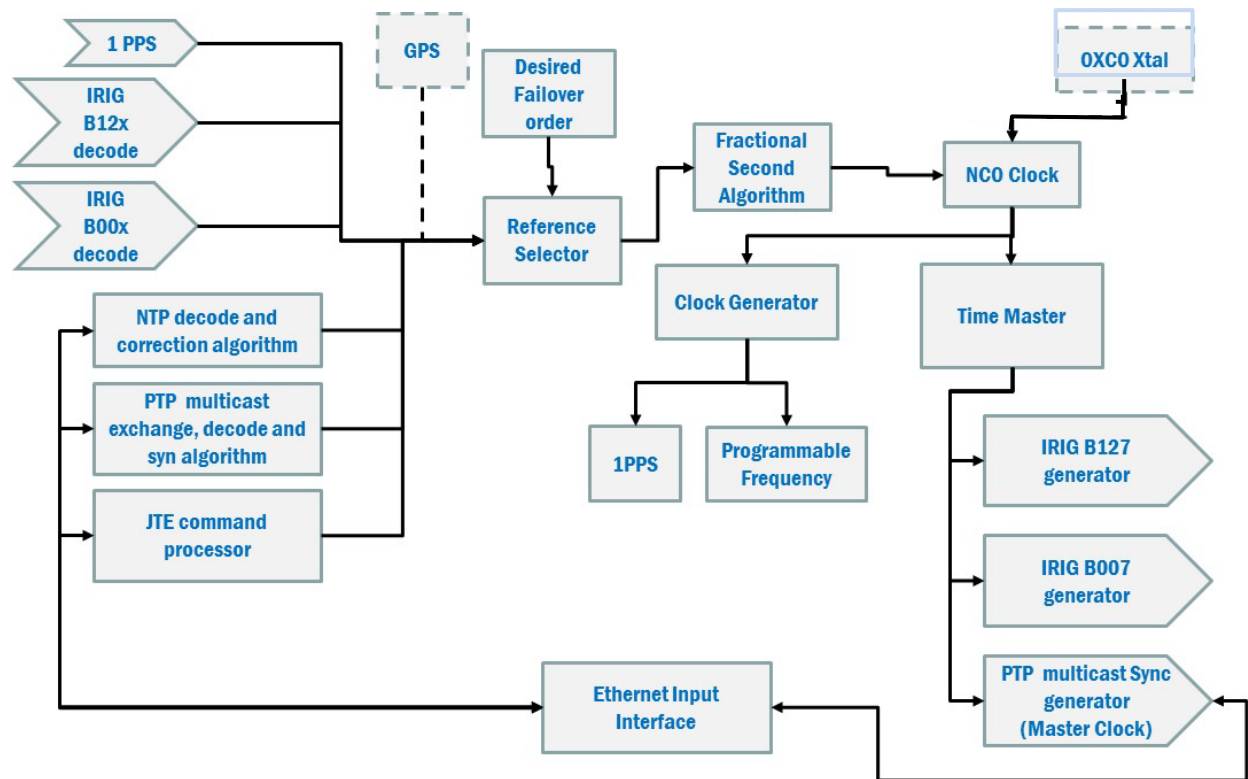
1.1   Janus Time Engine Master Controller (JTEMC)

The JTEMC receives both IRIG B12x and IRIG B00x (single-ended[1]) time reference inputs, a single-ended 1PPS reference input. There is a GigE Ethernet interface that enables the MJTE Master Controller to slave to a PTP (IEEE1588) master clock or synchronize with an NTP server.

1.1.1 Time Master

The JTE Master Controller will accurately synchronize its internal time master to a user selected external time source.   The time master is driven by a numerically controlled oscillator (NCO)

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[1] Differential inputs for both IRIG B00x and 1PPS are available on the Interface board.

oscillator that disciplines an OXCO crystal. Disciplining strategy calibrates out any crystal frequency error (absolute and aging) and adjusts the drive clock to deliver a fixed number of counts between one-second ticks (fractional seconds). The scale of the fractional seconds is 25 nano seconds. NCO disciplining of the OXCO oscillator delivers time master unlocked drift of 36 μsec/hr. after an hour locked to one of the time references listed below.

The time master may be synchronized by one of the following time references:

1. IRIG B12x (coax); B120-B003 require a manual YY[2] input.
2. IRIG B00x (single-ended or differential); B000-B003 require a YY[2] manual input.
3. 1PPS (single-ended or differential); requires a manual YY[2], MM, DD, HH, MM, SS input.
4. Network Time (PTP or NTP; mutually exclusive).
5. Internal GPS receiver (Optional); requires a powered (3.3-5 VDC GPS antenna).

These references may be arranged in a priority order should the primary time reference fail or synchronization be lost. The priority order will be used to select the next available reference source for synchronization.

Progress through the priority list continues in a rotating fashion until a valid reference is found and the MJTE can be synchronized to it. Should none be available, time will continue to be generated driven by the NCO, however accuracy will drift as specified earlier. At the moment a valid source does become available, that time reference will be used to synchronize the time master.

The accuracy of the time master varies with the reference used as described in the table below.

Reference	1 Sec Tick alignment	Notes
IRIG B12x	2±2 μsec	Dependent on signal quality
IRIG B00x	25±50 μsec	This input may be configured to receive a single ended or differential TTL time code signal.
1PPS	25±25 nanosec	This signal is used to align the time master 1-second rollover. The absolute YY,DDD,HH,MM,SS must be set by command. This input may be configured to receive a single ended or differential TTL time code signal.
NTP	Range from 5 μsec to milliseconds	Depends on network configuration, number of nodes and location of the NTP server selected. A command is available to set the IP address of the desired NTP server with which to synchronize.

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[2] The century value is assumed to be 20 which the first two digits of a 4-digit year value.

Reference	1 Sec Tick alignment	Notes
PTP	75±50 nanosec	Each node between the grand master clock and the MJTE must be PTP compliant to deliver this time accuracy. The MJTE will not synchronize to an PTP clock on the network when set to function as a PTP Master clock.
GPS (optional)	15±15 nanosec	Not less than 3 satellites in view as reported by the GPS to establish a fix. One satellite required to maintain lock.

1.1.2 IRIG B Inputs

The JTE Master Controller includes both IRIG B 12x or IRIG B 00x time code inputs. The system parses and decodes these streams when available to extract the year (if available), day, hours minutes and seconds that are encoded by the IRIG B time code signal (all 'Control Function' and 'Straight Binary Seconds' bits are ignored). If a decodable signal is available, it will be marked as "available" and can be selected for use in the reference priority list.

The JTE Master Controller will also extract the 1PPS signal embedded in the time code and use it as a transfer standard to adjust the NCO clock to synchronize the fractional seconds of the time master.

If the year data is not available in the IRIG time code (B122 or B002 for example), the year must be entered by command (see 4.0 ASCII Command Set page 24).

The IRIG B12x input is transformer isolated by a 600Ω input impedance audio transformer offering complete isolation from all other inputs to the system. A modulated input signal of 3 Vp-p to 10 Vp-p having a 2:1 to3:1 encoding modulation is required for proper synchronization.

The IRIG B00x input has an impedance >1KΩ. The input signal must meet the requirements of a standard TTL input (threshold and noise margin) and shall have a jitter of less than 25 nanoseconds.

1.1.3 1PPS Inputs

The MJTE can receive both a single-ended TTL and differential pair (RS485) 1 PPS input.

This one second tick is used to adjust the NCO clock to synchronize the fractional seconds of the time master.

On power up, the time master will be set to the value of the Time Of Day (TOD) clock.

Since 1PPS has no value of time content, it is recommended that once the MJTE reports synchronization to the current 1PPS reference, a complete time value, YY[2],DDD, HH,MM.SS be sent at some time between the one-second ticks. This will correct for any cumulative error that may occur prior to synchronization of the time master and any cumulative drift error of the TOD clock while the MJTE is powered down.

1.1.3.1 Leap Seconds Requirement

When using 1PPS as the transfer standard when the MJTE is functioning as a PTP Master clock,

the manual time entered MUST be UTC and not local time. A current value (37 since January 1, 2017) must be entered for the Leap Second value (see 3.5.4 Leap Second Adjust on page 21 for details about leap seconds) as well when the MJTE is performing as a master clock.

1.1.4 GPS Time Reference

The optional GPS receiver will track up to 12 satellites and provide the absolute time and a 1PPS signal that is aligned to UTC within 30 nanoseconds when locked. When used, the time master may be synchronized to the internal GPS as the time reference. When the GPS is present, it is included in the priority list.

When it is intended to use the MJTE as a PTP Master Clock it is highly recommended to include the GPS receiver on the system or an external 1PPS. While the MJTE will operate as a PTP master clocking using an IRIG B12x time reference, accuracy is severely diminished. If the MJTE resides on the network with other PTP master clocks, the MJTE will not likely be selected as the network master.

If the GPS option has been purchased, it is important to ensure that the primary cell is properly installed to retain the GPS Ephemeris. If the Ephemeris is lost, GPS lock may take several minutes to achieve lock to GPS time.

1.1.5 PTPV2 Master Clock Function

When synchronized using a 1PPS reference or the optional internal GPS receiver, the JTE Master Controller may be set up to function as a PTPV2 (IEEE 1588 default profile) master clock. The JTE Master Controller will then announce itself as a master clock periodically. The sync packet rate will be programmable from 1/32 seconds to 8/sec in 15 steps (see 3.6Network Reference Settings page 19). The system will be capable of synchronizing up to 10 PTPV2 slaves.

All announce and slave-master communications will be accomplished via the GigE Ethernet port on the JTE Master Controller. There is no separate PTP Ethernet port.

As the PTP Master Clock, or PTP Best Master Clock, the JTEMC will synchronize its internal master clock to a reference such as the internal GPS (optional) or external 1PPS.

If the MJTE is the PTP Master or Best Master clock, the internal time master will always be indicated as LOCKED and the source shall be PTP.

If GPS (optional) or 1PPS is used as the transfer standard and lock is lost to them is during operation as a PTP Master or Best Master clock, MJTE will continue to generate PTP signaling, but time will drift from the transfer standard by up to 36 µS/hr. If the MJTE was selected as the Best Master Clock, it may lose this status amongst the PTP clocks on the network (if any) and revert to perform as a slave (terminal device) to the newly designated Best Master Clock. When connected to a network with other PTP master capable devices, the MJTE will behave as described in 3.7 PTP Master/Slave Mode Behavior on page 23.

Be aware that if lock is reestablished with the active transfer standard(s), resynchronization may result in a jam sync event to all devices using the MJTE as a synchronized time source.

When the MJTE is operating as a PTP master clock it will announce itself as a master clock periodically. The sync packet rate will be programmable from 1/32 seconds to 8/sec in 15 steps.

All announce and slave-master communications will be accomplished via the 100/1000 Ethernet port.

When the MJTE is used as a PTP Master clock, the time reported with which to synchronize shall be UTC and will ignore any Time Zone Offset in slave packets synchronization.

The JTE Master Clock uses the IEEE1588 default profile.

1.1.6 Time of Day Clock

A Time Of Day (TOD) clock is provided that when the primary lithium cell is properly installed will maintain YY, MM, DD, HH, MM and SS values when powered down. TOD is not a low drift clock. The value of TOD is used to set the time master at power up. Time master accuracy is achieved after it has been synchronized to one of the available time reference sources.

The TOD is updated to equal the value of the time master once per second. This assures that the TOD clock is reasonably accurate even after long periods without powering up the MJTE. Power up accuracy will depend on the length of the power outage, variation in storage temperatures and the state of synchronization on last update from the time master.

If the primary cell fails or is removed, TOD will start at 00,001,00,00,00,00.

1.1.7 Time Zone Offset

When locked to GPS (option), NTP or PTP a time zone off set function is provided to localize the time reported, if desired. The time zone offset adds or subtracts 12 hours (15-minute corrections to the time are also available) to the UTC time reported by these references. Time Zone Offset is not applied when the reference is any IRIG source or 1PPS.

1.1.8 Ethernet

The Ethernet interface will support 100/1000 base-T transfer rates is set to auto-negotiate to the highest rate the network node will support.

Address assignment may either be determined by a DHCP switch or router or may be set to a fixed IP, port, gateway, and subnet mask. The factory default fixed IP address is 192.168.150.90; gateway of 192.168.150.100 and subnet mask of 255.255.255.0.

The socket functions support TCP/IP, UDP unicast and multi-cast protocols. TCP/IP ports are intended for commands, status and JSON objects. Appropriate UDP ports are used to support IEEE 1588 (PTP) communications.

The Ethernet interface also integrates a PTP hardware timestamping function for use when set to synchronize to or function as a PTP master clock.

The MJTE does not support IEEE 802.3/Ethernet PTP modes of communications.

If the MJTE is connected to a network and is in STATIC TCP/IP mode, it will attempt to establish an active link with the relevant switch or server using the preset static IP address. If in DHCP mode, the MJTE will request an available address from the network's DHCP server. If there is no DHCP server visible to the MJTE, an address will never be assigned in DHCP mode. However, the MJTE will, after approximately 2 minutes, revert to IP:STATIC mode and attempt to connect to the network using the previously assigned static address. Be aware that if the static address (factory default is 192.168.150.90) is out of the network address range, no connection

will be established.

Until there is a network connection, PTP/NTP slave, PTP Master and webserver functions will not be available.

1.1.9 Settings Flash

The following settings are saved to MJTE system flash such that each will survive a power cycle.

1. Amplitude setting of IRIG B127 carrier output
2. DHCP enabled/disabled state
3. Network Time selection as NTP or PTP (slave)
4. Output frequency of each clock (two)
5. Polarity of 1PPS input edge alignment
6. Polarity of both IRIG B00x inputs and outputs
7. Polarity of Clock A, Clock B, 1PPS output edge alignment
8. Preferred Time Reference
9. Propagation delay offsets for IRIG and NTP inputs
10. PTP terminal device or master clock setting
11. Static IP Address, Port, Gateway, and subnet Mask
12. Time Reference failover order
13. Time Zone Offset

1.1.10 I/O Interface

There is a 40-pin interface header that provides signals to the and from the Photo-Sonics Interface (PSI/O) PWA and the JTE Master Controller.   Power for the JTE Master Controller, 12 VDC, comes from the PSI/O.

Differential IRIG B00x and 1PPS reference signals come from the PSI/O.

Controls and signals used to manage the PSI/O route through this interface.

This interface is NOT PC104 compliant and shall never be attached to a PC104 stack.

1.2   Photo-Sonics Interface (PSI/O)

Controls and data received from the JTE Master Controller I/O Interface ensure properly synchronized timing and frequency outputs.

The PSI/O also receives differential 1PPS and B00x signals and delivers them to the JTE Master Controller for time master synchronization.

1.2.1   Time code and frequency output ports

The PSI/O provides multiple time outputs that are to be simultaneously available each aligned to the time master.

The time code and frequency outputs are as follows.

Output	Characteristics	Notes
1PPS	10 Ω, TTL buffered output capable of driving 10 TTL loads. Short circuit protected. SE output termination 50 Ω DE output termination 120 Ω	Programmable phase as rising edge aligned to 1-second tick or falling edge to 1-second tick. This is a dual output where a set of pins is TTL and the other is differential. Both outputs are active.
Clock A	10 Ω, TTL buffered output capable of driving 10 TTL loads. Short circuit protected. SE output termination 50 Ω	Frequency is programmable from 1Hz to 10 MHz in decade steps. Programmable phase as rising edge aligned to 1 second tick or falling edge to 1 second tick.
Clock B	10 Ω, TTL buffered output capable of driving 10 TTL loads. Short circuit protected. SE output termination 50 Ω	Frequency programmable from 1Hz to 999 Hz in 1 Hz steps. Programmable phase as rising edge aligned to 1 second tick or falling edge to 1 second tick.
IRIG B007	10 Ω, TTL buffered output capable of driving 10 TTL loads. Short circuit protected. SE output termination 50 Ω DE output termination 120 Ω	This is a dual output where a set of pins is TTL and the other is differential. Both outputs are active.
IRIG B127	75 Ω, transformer isolated.	Programmable carrier output from 1 Vp-p to 9.9 Vp-p.

The disciplined drive frequency (NCO output) and fractional second roll over are used to phase lock and accurately synchronize all the above outputs.

1.3 IRIG B time code generator

The IRIG B time code generator samples the current time on the fractional second rollover of the time master and generates both B007 and B127 timecode streams.

1.3.1 An IRIG B127 output buffer

The IRIG B127 AM signal stream is isolated from the output through an audio transformer having a 600 Ω output impedance. The primary is driven by an independent adjustable gain (webserver or command-line adjustment) amplifier offering a peak to peak amplitude range of 1-10 Vp-p.

1.3.2 An IRIG B007 output buffer

The IRIG B007 time code output is a buffered and short circuit protected TTL output capable of driving up to 10 TTL loads for up to 100 meters of 50Ω coax or twisted pair terminated by 50Ω.

A combination of pin sets and a settings command may be used to physically configure this output to be either single ended or differential pair.

Webserver or command-line settings may invert the polarity of these outputs independently.

1.4 Programmable Frequency Generators

Two programmable frequency generators are synchronized, and phase locked to the time master such that a leading edge of each TTL clock output aligns within 50 nanoseconds of the fractional seconds rollover of the time master.

1.4.1 Clock A

The Clock A generator can be set to output 1 Hz (factory default), 10 Hz, 100, Hz, 1000 Hz, 10 KHz, 100 KHz, 1 MHz and 10 MHz by either the webserver or command-line.

The TTL output is buffered and short circuit protected.

1.4.2 Clock B

The Clock B generator can be set to output 1 Hz (factory default) to 1000 Hz in 1 Hz steps by either the webserver or command-line.

 The TTL output is buffered and short circuit protected.

2.0 NETWORK TIME SYNCRHONIZATION

The MJTE may be synchronized to network time. Network time is either Network Time Protocol (NTP) or Precision Time Protocol (PTP; IEEE 1588v2). Selection of these is mutually exclusive.

When it is desired to synchronize to either NTP or PTP, the first selection is Network Time Protocol. There is no fail over capability from PTP to NTP or NTP to PTP. If Network Time fails one of the other time references (IRIG B12x, B00x, 1PPS or GPS) will be selected if available.

2.1 NTP Decode/Correction

The NTP synchronizer requires a valid and reachable TCP/IP address to establish a client (JTE Master Controller)/server (NTP clock) relationship. Once a client session is begun with the NTP server, the JTE Master Controller will use its time and compensate for measurable loop delays.

The JTE Master Controller adjusts the NCO frequency driving the time master such that there is a fixed number of counts between one second intervals such that the seconds rollover is aligned with the NTP server. This method avoids jam sync jumps in the fractional seconds.

When synchronization is successfully achieved and Network Time -NTP is selected, the JTE Master Controller will indicate a locked condition in the webserver and report such status via a command.

2.2 PTP Synchronizer Algorithm

The PTP is an IEEE standard 1588 V2 synchronizer that requires a PTP boundary or Grand Master clock be operating on the visible network. Once a UDP multicast session is established between the PTP master and the JTE Master Controller, the time message exchanges initiated by the PTP master clock will begin.

The details of the exchange are fully compliant with IEEE 1588 V2 for the default profile UDP packets. Fully compensated PTP time will be used to adjust the NCO frequency driving the time master such that there is a fixed number of counts between one second intervals and the zero rollover aligns with the PTP 1-second rollover. This method avoids jam sync jumps in the fractional seconds.

When synchronization is successfully achieved and Network Time – PTP is selected, the JTE Master Controller will indicate a locked condition in the webserver and report such via a command.

3.0 WEBSERVER

When the Ethernet connection is set to DHCP (factory default), the address assigned to Janus by the network router or server will have to be known to the user. If set to a fixed IP address, that address must be used.

The webserver provides status of MJTE. Status includes the time, lock status and time reference in use (IRIG, 1PPS, Network Time or optional GPS).

The webserver is best used with MS Edge or Firefox.

It may be set to require login or not. If login is set, the correct username and password must be entered in order to gain access, for details see paragraph 3.3 Change Login page 16.

It is important to know that the cursor activates the page frame. When the cursor is moved to another frame, all remaining frames are disabled for input. In making changes to any settings, keep the cursor in the relevant frame until the change is reported back to the page. In addition, when a mouse pointer is within one of the frames, display update from the MJTE system will be suspended to avoid conflicts between the desired user input and status reported by the system. If the mouse is not moved for 15-20 seconds, updates will resume.

The general organization of the webserver is shown below.
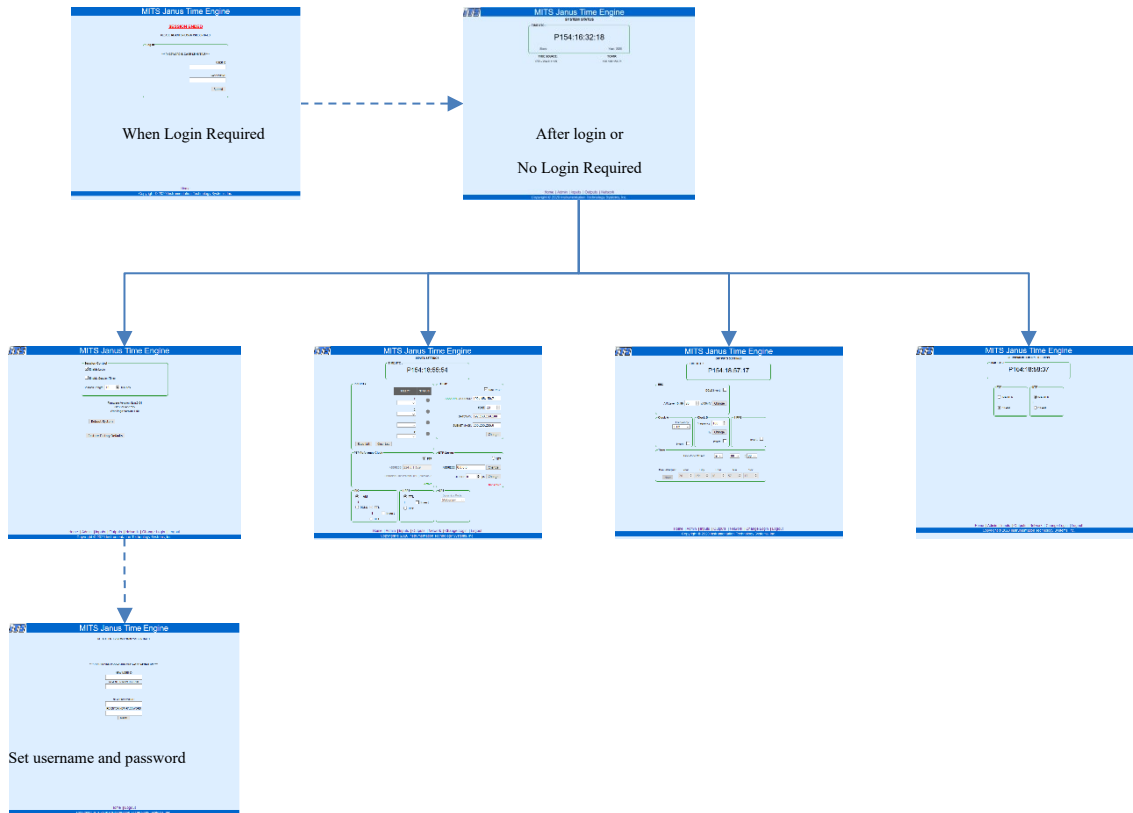
3.1   Home Page

When the MJTE is first addressed by a browser one will see either a home page requiring a login (left) or the operating home page (right).   After login, the home page on the right appears.
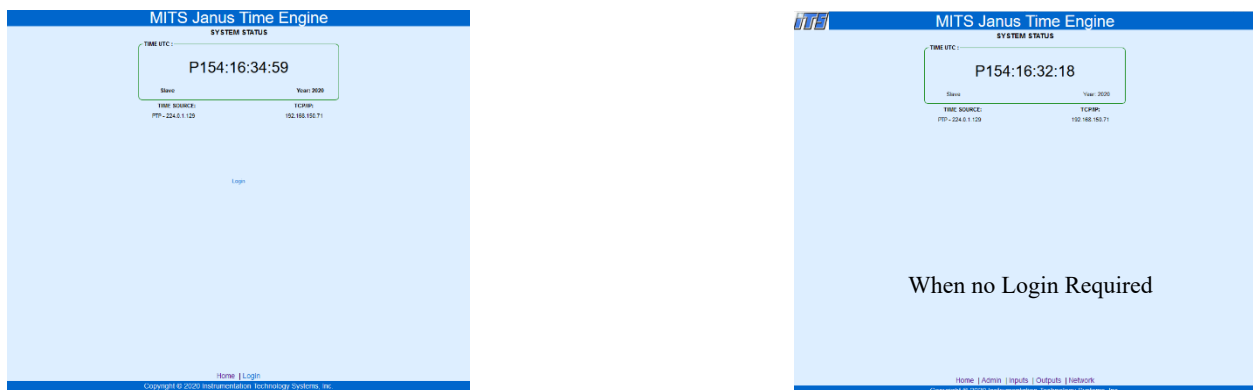
If login is required, MJTE status (time, reference, IP address and mode will not be revealed until successfully logged in.

When active, the home pages provide an overview of the MJTE.

3.1.1 Time frame

The label is **Time UTC** or **Time Local**. When synchronized to PTP or NTP, time is reported as UTC. The value set by Time Zone Offset is only used when locked to GPS, NTP or PTP. If no Time Zone Offset is set, the label will show **TIME UTC**.

The time master also reports the current year either set by a manual entry, TOD read at startup or updated by the time reference being employed if available.

Time to the second as read from the time master is updated every 500 milliseconds. The letter preceding the time indicates lock status to the active reference as follows:

1. **P or p**: The reference is PTP, one of the mutually exclusive network time references.
   Upper case indicates locked and lower case indicates it is unlocked.
2. **N or n**: The reference is NTP, one of the mutually exclusive network time references. Upper case indicates locked and lower case indicates it is unlocked but has communication with an NTP server.
3. **I or i:** The reference is IRIG B (either B12x or B00x). When IRIG B00x this will be the indicated reference whether it be TTL or differential. Upper case indicates locked and lower case indicates it is unlocked.
4. **S or s:** The reference is 1PPS whether TTL or differential. Upper case indicates locked and lower case indicates it is unlocked.
5. **G or g:** The reference is the optional internal GPS receiver. Upper case indicates locked and lower case indicates it is unlocked.
6. ***:** The time has been set by the TOD and the MJTE has not yet been synchronized to any of the available time references since power up.

The frame reports whether the MJTE is in Master (PTP master clock) or Slave (PTP terminal device) mode when in a Network Time mode as shown.

The current IP address of the MJTE is reported below the time frame as well as the selected time reference.
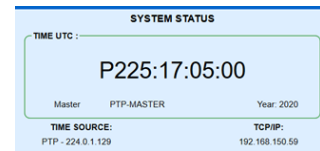
3.2 Admin page

The admin page provides the ability to set login and session parameters, reboot the MJTE, **Reboot System** and restore all settings to the factory defaults, **Restore Factory Defaults**.

The values of factory defaults are identified with the appropriate commands of the ASCII Command Set Section 4.0 on page 24.
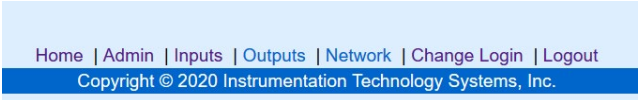
This page also reports the current MJTE, GPS receiver (if present) and web page firmware versions for reference.
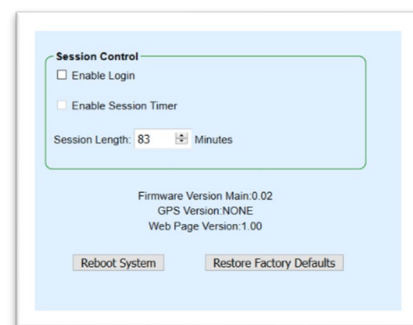
3.2.1 Session Control frame

The Session Control frame can turn on or off the requirement to log in when entering the webserver. If **Enable Login** is checked, and the current session is terminated for any reason, it will be necessary to login with a username and password pair.

When **Enable Login** is checked the menu at the bottom of the pages adds **Change Login** and **Logout.**

Home | Admin | Inputs | Outputs | Network | Change Login | Logout
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For better security, the **Enable Session Timer** may be checked. When checked any value of **Session Length** greater than 0 will cause the session to self-terminate the indicated time in minutes after the next login. If the **Session Length** is zero, self-termination will not occur just as though the **Enable Session Timer** were not checked.

If the session timer is enabled, a period of no activity that occurs equal to or greater than this setting will cause the webserver to automatically log out. A new login will be required.

When restoring to factory defaults, the default username and password pair will also be restored.
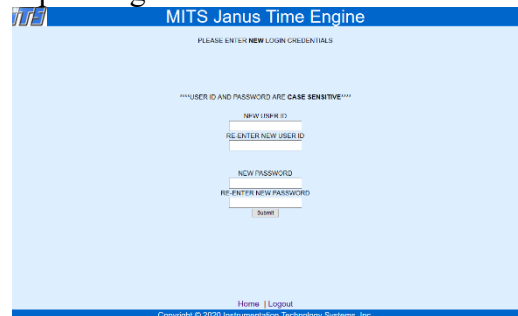
3.3 Change Login page

The Change Login page is only accessible when Enable Login is checked on the Admin page. When accessible, you may enter a new username/password pair to gain access to the webserver.

The factory default username is *Admin*. The username is not case sensitive and may be a set of any valid characters.

The factory default password is *ITS19360*. The password is case sensitive and may be any set of valid characters.

Usernames are not case sensitive and can be any characters. Not more than 15 characters are recommended. Passwords are case sensitive and can be any characters. Not more than 15 characters are recommended.

3.4 Inputs page

The Inputs page provides a time status and controls to set all the adjustable parameters offered by the MJTE.

3.4.1 Priority frame

The Priority frame enables the user to set the order in which time references that are available to selected by the MJTE. The order (1 – 4) is the order of priority.

The drop down list (IRIG, GPS (if present), PTP/NTP, 1PPS) is the same in each selection, however, if IRIG is selected as priority 1 (as shown), this selection will not be accepted for any other priority.

A priority level may not be skipped. That is if an input for priority 1, 3 and 4 is selected (skipped priority 2), fail order will not work. Loss of IRIG as shown as priority 1 will not result in selection of the priority 3 choice as in this example choice 2 would be blank.

When a time reference is selected, that status of that source is displayed. Green indicates that it is selected and is a valid source. Yellow indicates that it can be used as a time reference, however it is not being used as the reference and the time master is not locked to it. If the indicator is dark (gray), this input is either not available or has been invalidated by the MJTE for some error conditions.   Consequently, this reference will be skipped over if a fail over sequence is initiated.

If **Save List** is clicked, the current priority list is saved to MJTE flash memory and will be the default priority list at power up until changed. If **Clear List** is selected, this list will be cleared from MJTE flash memory and will not be shown on the page.

3.4.2 TCP/IP Frame

The TCP/IP frame provides the ability to set the Janus TCG to receive addresses from a DHCP server (factory default) on the network to which it is attached. When **Use DHCP** is checked it will cause the Janus TCG to automatically connect to your network.

In DHCP mode, the Janus TCG will attempt to receive an address from a DHCP server for two (2) minutes. In the event there is no DHCP server on the network or it is not accessible to the Janus TCG, is will automatically revert to STATIC IP mode. In this mode, connectivity may be achieved by a host on the network able to address it via the current STATIC address.

The current mode status reflects **STATIC** or **ASSIGNED** (DHCP). When assigned, the assigned address data is shown in the ADDRESS box and on the front panel of the Janus TCG.

The Factory Default static address is 192.168.150.90 with a Gateway of 192.168.150.100 and a Subnet Mask of 255.255.255.0.   These values may be changed at any time within the **TCP/IP** frame by entering them and clicking **Change**. The values will not be saved until the **Change** button is clicked. When clicked, the values become effective immediately and are saved to internal FLASH memory which will cause them to survive a power cycle.

While the static address, gateway and subnet mask may be any valid value, they must be values that are available and accessible within the applicable network.

3.4.3 Network Time Reference

The Network Time reference is comprised of two frames: the PTP Reference Clock and the NTP Server. Network Time is a choice for a time reference. The selection of NTP or PTP are mutually exclusive. This means that the system is set up for one or the other, not both. In changing the setting from one to the other, the MJTE must do a reboot which will take time to complete. Once complete the desired reference will be available for the PTP/NTP dropdown selection and only the one that the MJTE has been set up for before reboot.

3.4.3.1 PTP Reference Clock

The PTP as a slave only requires that PTP be set as the network time source. If a PTP master clock is found and communications are established, the UDP address of the PTP clock will be shown in the **ADDRESS** box. PTP will be shown as **Active** in the **PTP Reference Clock** frame. This frame will be shone as **Not Active** if NTP is selected. IEEE 802.3/Ethernet messaging is not supported, therefore MAC addresses will not be collected or shown.

3.4.3.2 NTP Server

When NTP is selected (a radio button connected to the PTP radio button) the IP address of the desired NTP server must be entered in the **ADRESS** text box of the NTP Server frame. A missing or invalid address will disable the ability of the MJTE to create an NTP client-server communications socket. The address is not actually set in the MJTE system until the Change button is clicked. When clicked, the value is changed, and this value is saved to flash becoming the new default for this setting.

The OFFSET is a value in microseconds that is a fixed correction to the NTP time. While NTP attempts to determine the path length from the server to the client (MJTE) it may be necessary to add (+ or - value) a correction to this time to result in a more accurate synchronization. This value is not added to the time calculation until the Change button is clicked. When clicked this offset value is saved to MJTE flash and becomes a new default value.

3.4.4 IRIG Reference

It is important to specify which form of IRIG reference is to be used. The choices are mutually exclusive in that only one form of IRIG may be used as a reference. The selection of AM or DCLS is determined by the status of a radio button pair. Choosing AM is choosing that an IRIG B12x time code source is being used. Any DCLS IRIG B time code source physically connected will be ignored. The specifications of the IRIG B12X are defined in 1.1.2 IRIG B Inputs on page 7.

When DCLS is selected any IRIG B12X signal physically connected to the MJTE will be ignored. DCLS is an IRIG B00x TTL time code stream.

There are several choices to make when using DCLS. The input selection may be either single-ended TTL (**TTL**) or differential RS485 (**DIFF**). Once more, these choices are mutually exclusive. That is, if TTL is chosen any differential input will be ignored and vice versa.

It is also possible to invert the TLL or Differential signal if necessary, to normalize the DCLS time code stream.

These selections are instantaneous, are saved to MJTE flash, and become the new defaults.

An IRIG reference can never be used as a transfer standard when the MJTE is used as a PTP Master Clock. PTP must report UTC time, IRIG time is generally reported at local time.

3.4.5   IRIG Delay Compensation

The IRIG Delay Compensation is an offset to the IRIG B12x received as a time reference by the MJTE. This setting adds 125 nS to the received time for each integer value entered (#x125 ns). For example, entering a value   of 10 adds 1.25 microseconds to the received IRIG B12x time. The offset value is not entered until the Change button is clicked. This value will also be saved to MJTE flash and will survive a power cycle.
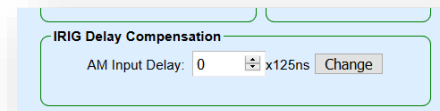
3.4.6   1PPS Reference

The 1PPS reference is a clock input having a frequency of 1 pulse per second. It is presumed that this reference is clock is precisely at one tick per second and can be used as a precision time reference.   There are two inputs that may be chosen mutually exclusively, single-ended **TTL** or differential (**DIFF**). By selecting the **Invert** check box, this input will invert the phase of the signal used by the MJTE.

These values are instantaneous, are saved to MJTE flash, and become the defaults.
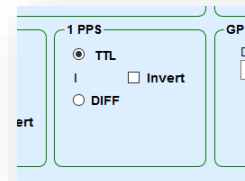
3.4.7   GPS Reference

The GPS is an optional reference and must be included at the time of order. This is not a field upgrade. If present, one may select the **Dynamics Mode** by which the GPS Kalman filter evaluates a position and time solution. Stationary is the tightest tolerance and yields a circular error position of approximately 3 meters. Each other selection indicates greater and higher acceleration motion. For the GPS to provide a sustainable lock condition, the tolerance of error must be increased (the dynamics mode) to accommodate the anticipated motion vectors.
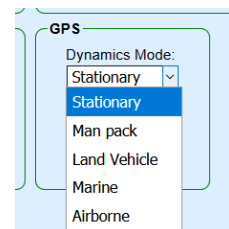
Any value selected is instantaneous, will be saved to MJTE flash and becomes the new default.

3.5 Outputs Page

The Outputs page provides the ability to set the IRIG B127 peak-peak output level, set clock output frequencies and polarity, enter a time zone offset, manually input time and manually input the current value of leap seconds.

3.5.1 IRIG Frame

The IRIG frame permits one to invert the IRIG B007 (DCLS) TTL output time code pulse train.

Checking the box inverts the signal. When the box is unchecked (factor default) the signal is normal polarity.

The IRIG B127 output peak to peak output level can be adjusted as low as 1 Vp-p to 9.9 Vp-p. The factory default is a value of 30 (3 V p-p).

Neither of these values become effective until the Change button is clicked. When clicked these values are also saved to flash so that they will survive a power cycle.

3.5.2 Clocks Frames

There a three clock frames, Clock A, Clock B and 1PPS as shown.

The **Clock A** frame provides a control to set this clock from 1Hz to 10 MHz in decade steps. A drop down is provided for this setting. The factory default is 1 Hz.

The **Invert** check box when checked inverts the TTL signal.

The **Clock B** frame provides a control to set its output frequency from 1 Hz (1PPS) to 1000 Hz in 1 Hz steps. The factory default is 1 Hz.

The **Invert** check box when checked inverts the TTL signal.

The IPPS frame **Invert** check box when checked inverts the TTL signal.

All these settings are effective immediately and will be saved to flash within one-second such these all survive a power cycle.

3.5.3 Time Frame

The time frame provides a **Time Zone Offset** input. This value is only used when the time reference is any network time source (PTP or NTP) or when synchronized to the internal GPS (optional). Its value is intended to localize time from UTC.

The offset can be + or – relative to UTC values (all USA time zone offsets are negative values) and is set in hours 00 to12 via a drop down list and may also be adjusted further in 15 minute increments as shown from a second drop down. Thus, a selection of – 01 30 subtracts an hour and 30 minutes from UTC time.

The setting is immediate on the next second update and is saved to flash within 1 second of entering a value so that it survives a power cycle.

If the only available time reference transfer standard contains no date or time information (e.g. a 1PPS reference), the time may be set manually. The **Manual Adjust** requires a *Year* (last two digits), Julian ***Day***, ***Hour***, ***Min***utes and ***Sec***onds entry value. In order to set this to within a second of accuracy the seconds should be set ahead of real time.

When the real time matches the HH:MM:SS value, click the Now button before the next real time second ticks.
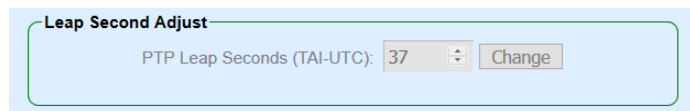
When synchronized to 1PPS the 1 second rollover will be synchronized to the 1PPS tick. If the MJTE becomes synchronized to an IRIG B signal, the time will be overwritten by that time code. If the time code is B123 or less (B003), it is necessary to enter a year value manually using this control. The time (DDD,HH,MM,SS) will be overwritten by the time code.   The time code offset is not used to adjust either the manual or IRIG times.

If the MJTE becomes synchronized to the optional GPS, an NTP or PTP clock, the manual time setting will be overwritten entirely by the values embedded in those sources including year.   The Time Zone offset, if any, will also be used to report time in any IRIG output.

3.5.4 Leap Second Adjust

A leap second is a one-second adjustment that is occasionally applied to Coordinated Universal Time (UTC), to accommodate the difference between precise time (as measured by atomic clocks) and imprecise observed solar time (known as UT1 and which varies due to irregularities and long-term slowdown in the Earth's rotation). The GPS constellation provides leap seconds data used by GPS receivers to provide a final corrected time. Similarly leap second values are provided by NTP and PTP master clocks as part of the synchronization data needed by devices attempting to slave to and apply accurate time as needed.

In the event that the MJTE is set to perform as a PTP Master Clock, and the MJTE is synchronized by a 1PPS source, the current value of leap seconds must be manually entered such that the MJTE provided all of the synchronization data required by the IEEE1588 specifications for a master clock.

The PTP Leap Seconds control provides the ability to enter the current value of leap seconds in use. It must be the current value and when a new value is in use   This link, https://hpiers.obspm.fr/eoppc/bul/bulc/UTC-TAI.history, will reveal the current value of leap seconds in use.   This setting is only active when the MJTE is set to be a PTP (IEEE 1588) master. When active, enter the value and click on the Change button to set the value and cause to be saved to flash. This setting will survive a power cycle.

A value MUST be entered for the MJTE to be operated within as a Master Clock PTP/IEEE 1588 specifications when synchronized by an IRIG or 1PPS source.

When synchronized by the optional GPS receiver, the leap seconds will be "set" to that reported by the GPS receiver.

3.6   Network Reference Settings page
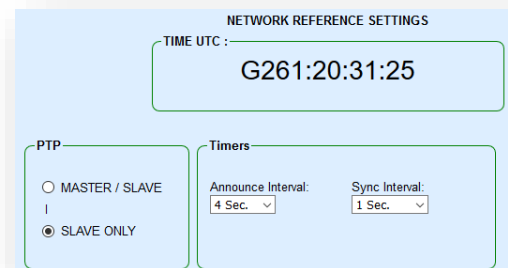
The network page is used to set the MJTE as either a PTP master clock or a PTP terminal device (slave).

3.6.1 PTP Frame

MASTER/SLAVE or SLAVE ONLY selections are mutually exclusive for the network time setting.

Whichever mode is set, it will be used to determine how the MJTE behaves when Network Time is chosen.

If the MJTE is selected as a PTP MASTER/SLAVE, it will behave as an ordinary clock as defined by IEEE1588 V2. PTP announcements and synchronization messaging with each slave will be via the common GigE ethernet port.

3.6.2 Timers Frame

The Timers frame sets PTP master behavior. The Announce Interval sets how frequently the PTP as a master clock transmits UDP announce packets into the network. Announce packets inform the network that the MJTE is present and available to synchronize with.   When acting as a PTP Master, the Sync Interval determines how frequently the MJTE transmits Sync packets.

The Timers frame and its settings are disabled when NTP is set as the reference clock on the Inputs page.

The best time accuracy when chosen as a master is achieved when the GPS receiver (optional) is the transfer standard. The MJTE can also function as a master using 1PPS. PTP terminal devices (slaves) on the network will use their best master clock algorithm (BMCA) or IEEE1588

profile set in the Master Clock to determine to which master to synchronize. This process may exclude the use of the MJTE if another master clock is present, visible on the same network and deemed the best master clock.

The MJTE may never both act as a master and slave at the same time for any protocol (PTP or NTP).

3.7   PTP Master/Slave Mode Behavior

When the MJTE is in **MASTER/SLAVE** mode the presumption is that it is intended for the MJTE to be locked to an optional internal GPS receiver or an acceptable external transfer standard. The implied priority then is GPS or 1PPS. If the MJTE resides on a network with other masters, the IEEE1588 Best Master Clock Algorithm (BMCA) may result in determining that another PTP master clock should be the network PTP master clock. In this instance, the MJTE will cease transmission of Announce and Sync messages and listen for such from the BMCA winner.

The MJTE will not revert to PTP slave mode while it remains locked to its transfer standard (optional GPS or 1PPS). However, if lock is lost from the transfer standard, the MJTE will then revert to PTP slave mode and lock to the BMCA network PTP Master Clock winner if available.

It will still be listening to the network. If all other PTP masters cease sending announce and sync messages, the MJTE will again attempt to become the PTP network master clock provided lock to its transfer standard is true.

When the MJTE is set to SLAVE ONLY mode, the priority list always prevails. That is, if the priority list is PTP, GPS, 1PPS for example, when PTP is available the MJTE will synchronize to it. If PTP is lost, it will synchronize to the internal optional GPS receiver or the external 1PPS if available. If PTP availability is restored, it will automatically revert to PTP synchronization mode.

4.0 ASCII COMMAND SET

The table below is a list of commands that can control the setup of JTE.   All commands are ASCII strings specified.

When ^Y is used in a command string, it is the HEX value of 19, ^S is HEX 13, ^T is HEX 14

Group	Command	String	Variable values	Notes
1PPS	1 PPS IN	^YPMx	x=0,1 where 0 = TTL 1 = DIFFERENTIAL	
		^YPM?	Return =(19h)PM(32h)value<CR> as ASCII Value = 1 or 0	
1PPS	Invert 1 PPS IN	^YPIx	x=0,1 where 0 = is in phase with 1 sec. tick 1 = inverted phase	
		^YPI?	Queries the current value Return =(19h)PI(32h)value<CR> as ASCII Value = 1 or 0	
1PPS	Invert 1 PPS OUT	^YPOx	x=0 is in phase with 1 sec tick =1 is inverted phase	
		^YPO?	Queries current value Return=(19h)PO(32h)value<CR> as ASCII Value=1 or 0	
Clocks	Clock A Out	^YCAx	Where when x= 0 =1pps (factory default) 1 =10pps 2 =100pps 3 =1,000pps 4 =10,000pps 5 =100,000pps 6 =1,000,000pps 7 =10,000,000pps	

Group	Command	String	Variable values	Notes
		^YCA?	Queries current value Return =(19h)CA(32h)valueHZ<CR> as ASCII Value= 1Hz,10Hz,100Hz,1kHz,10kHz,100kHz, 1MHz or 10MHz Example: (19h)CA 10Hz<CR>	
Clocks	Clock B Out	^YCBxxxx<CR>	Where xxxx=0001 (default) to 1000 The value of xxxx produces an output of 1 to 1000 Hz, respectively.	
		^YCB?	Queries current value Return=(19h)CB(32h)value<CR> Value = 1Hz-1000Hz Example: (19h)CB 101Hz<CR>	
Clocks	Invert Clock A out	^YCIx	x=0 is in phase with 1 sec tick =1 is inverted phase	
		^YCI?	Queries current value Return=(19h)CI(32h)value<CR> as ASCII Value=1 or 0	
Clocks	Invert Clock B out	YCNx	x=0 is in phase with 1 sec tick =1 is inverted phase	
		YCN?	Return=(19h)CN(32h)value<CR> as ASCII Value=1 or 0	

GPS	GPS DYNAMIC MODE	^YDMn	n= 1 to 5 where
			
			  1 = Stationary (Factory Default)
			  2 = Man Pack
			  3 = Land Vehicle
			  4 = Marine
			  5 = Airborne
				Only if the GPS option has been purchased.

		^YDM?	Queries current value Return =(19h)DM(32h)value<CR> where value=1-5,0 (none)	

Group	Command	String	Variable values	Notes
IRIG	IRIG Delay Comp	^YICAnnnnn	Where nnnnn is any positive integer value from 0 to 1600 which represents a multiplier for 125 ns. The value of 1600 would yield a delay compensation of 200μS.	This value only applies to time received from an IRIG B12x source.
		^YICA?	Queries the current value Return= (19h)ICA(32h)*value*ns<CR> as ASCII Value is 0 to 2000 Example: (19h)ICA(32h)2000ns<CR>	
IRIG	IRIG IN Source	^YISx	x=0,1 where 0 = AM 1 = DCLS	
		^YIS?	Queries current value Return =(19h)IS(32h)value<CR> as ASCII Value = 1 or 0	
IRIG	DCLS IRIG IN	^YIMx	x=0,1where 0 = TTL 1 = DIFFERENTIAL	
		^YIM?	? = Queries current value Return =(19h)IM(32h)value<CR> as ASCII Value = 1 or 0	
IRIG	INVERT DCLS IRIG IN	^YIRx	x=0,1 where 0 = is in phase with 1 sec. tick 1 = inverted phase	
		^YIR?	Queries current value Return =(19h)IR(32h)value<CR> as ASCII Value = 1 or 0	
IRIG	Invert B007 DCLS out	^YIIn	x=0,1 where 0 = is in phase with 1 sec. tick 1 = inverted phase	

Group	Command	String	Variable values	Notes
		^YII?	Queries current value Return=(19h)II(32h)value<CR> as ASCII Value=1 or 0	
IRIG	Set IRIG B127 output amplitude	^YILaa	aa = 10 to 99 Factory default is 30 (3Vp-p)	The value aa *100 is the number of millivolts p-p of the output.
		^YIL?	Queries the current value Return =(19h)IL(32h)####mV<CR> as ASCII #### range 1000 to 9900	
Misc.	Time Message	^ S	Samples the current value of the time master on receipt. Returns: (13h)TI(32h)*DDD:HH:MM:SS.ssss<CR> (ascii) where * is lock status (*,N,n,P,p,I,i,S,s,G,g) DDD= day of year HH= hour of day MM= minutes of hour SS.ssss = seconds.fractional seconds	
Misc.	JTE versions	^YVQ	Returns the firmware version, GPS version and MJTE serial number. The string format is: (19h)VQ(32h)S/N:####,Main:#.##,GPS:########_EXT(32h)CORE #.##(32h)(######)<CR>	The length of this string may change over time with main and GPS version numbers. If no GPS receiver is present, the return changes to …GPS NONE.
Misc.	Reboot System	^YRB<CR>	Reboot. This may take a minute. Connection to the NTP server or resynchronization to PTP may take a few minutes. If using the webserver, it will be necessary to reestablish the browser connection. If DHCP is enabled there is a chance that the router/switch connected to the port will be assigned a new address.	
Misc.	Reset to Factory Defaults	^YFDY	This command will return all settings back to the values when shipped from the factory. DHCP will be ON which may require rediscovery of the IP	

Group	Command	String	Variable values	Notes
			address assigned to the unit.	
Netwrk	DCHP or Status IP mode	^YDHn	n='0'; disable DHCP n='1'; enable DHCP (factory default)	ITS offers an ITS Client Discovery software that can detect and report the current IP address of any of its products on your network.
		^YDH?	Queries DHCP state return = (19h)DH(32h)DHCP(32h)ON<CR> (enabled) or (19h)DH(32h)DHCP(32h)OFF<CR> (disabled)	
Netwrk	Static IP Address	^YNS ###.###.###.###, ggg.ggg.ggg.ggg,sss.sss.sss.sss,ppppp<CR>	###.###.###.### =IP address, ggg.ggg.ggg.ggg =the gateway, sss.sss.sss =subnet mask values. 'ppppp =port address (23 is telnet), Factory default=192.168.150.90, 192.168.150.100,255.255.255.000-0023	Any valid IP address.
		^YNS?	Queries the current network values Returns network information as ASCII string. Value formatted as: (19h)NS(32h)DHCP mode, IP address,Gateway address,Network mask,Port number<CR> Example (19h)NS(32h)OFF,192.168.150.90, 192.168.150.100,255.255.255.0,23 <CR>	Leading zeros are removed.
NTP	NTP Server Address	^YNT###.###.###.###[-ppp]<CR>	###.###.###.### =NTP server address [] indicates optional characters do not include in the input string. - = declares addition of the offset option ppp = a value (offset) -99 to +99 Factory default = 000.000.000.000	Default is 000.000.000.000 and has no functional value unless the JTE is in NTP slave mode.
		YNT?	Queries current NTP address Return=(19h)NT(32h)###.###.###.###:###<CR> as ASCII	

Group	Command	String	Variable values	Notes
PTP	PTP/NTP Network Time Source	^YTSxn	x= P,N,S when x=P (PTP master/slave) n= 0,1 0=Master 1=Slave when x=N (NTP master/slave) n= 0,1 0=Master 1=Slave when x=S (NTP/PTP as source) n= 2,3 2=NTP as source 3=PTP as source	
		^YTS?	Queries the current value Return =(19h)TS(32h) value\<CR> as ASCII Value= (19h)TSNTP:Slave, (19h)TS(32h)PTP:Master or (19h)TS(32h)PTP:Slave	
PTP	PTP Master Settings	^YPTxnn	x=timer type where A=Announce timer (+0 to +6) S=Sync Timer (-5 to +3) nn=value (log =2^{nn}) where nn All negative values are for x=S only 6 = 64 sec; x=A only -5 = 1/32 5 = 32 sec; x= A only -4 = 1/16 4 = 16 sec; x= Aonly -3 = 1/8 3 = 8 sec -2 = 1/4 2 = 4 sec -1 = 1/2 1 = 2 sec 0 = 1 sec	Up to 10 subscribers may be registered to the JTE. Up to 10 boundary clocks and/or PTP terminal devices may be synchronized by the JTE.
		^YPT?	Queries the current value Return =(19h)PT(32h)A:nn, S:nn\<CR>	
Time Ref	PRIORITY A source	^YPAx	x=1,2,3,4, where 1 = IRIG 2 = GPS (if present) 3 = PTP/NTP (factory default) 4 = 1PPS	Priority A is always the DESIRED MASTER, if available. NTP w1ll not be available without a server address. GPS will not be available without the option installed. Priority selections must always be in sequential
		^YPA?	Query current value Return =(19h)PA(32h)value\<CR> as ASCII Value=NONE, IRIG, GPS, PTP/NTP or 1PPS	

| Group	Command	String	Variable values	Notes

Time Ref	PRIORITY B source	^YPBx	x=1,2,3,4 where
			  1 = IRIG
			  2 = GPS (if present)
			  3 = PTP/NTP (factory default)
			  4 = 1PPS
				order. That is, 1,2,3,4. You may not skip a priority (e.g. 1,3,4). Skipping a priority will cause the round robin search to stop at the blank priority number.

		^YPB?	Query current value Return =(19h)PB(32h)value<CR> as ASCII Value=NONE, IRIG, GPS, PTP/NTP or 1PPS	Priority sequence is round robin and will progress in circular order until a sync is achieved. Time between steps may be as long as minutes since achieving sync with any one master source is not instantaneous.

Time Ref	PRIORITY C source	^YPCx	x=1,2,3,4 where
			  1 = IRIG
			  2 = GPS (if present)
			  3 = PTP/NTP (factory default)
			  4 = 1PPS	

		^YPC?	Query current value Return =(19h)PC(32h)value<CR> as ASCII Value=NONE, IRIG, GPS, PTP/NTP or 1PPS	If 1PPS the TOD clock will set the YY,DDD,HH,MM,SS or it may be overridden by command. If using 1PPS as a transfer reference in PTP Master Clock mode set UTC time, if an IRIG reference is applied that does not include the year, the YYYY value will be that read from the TOD until overridden by command.

Time Ref	PRIORITY D source	^YPDx	x=1,2,3,4 where
			
			  1 = IRIG
			  2 = GPS
			  3 = PTP/NTP
			  4 = 1PPS	

		^YPD?	Query current value Return =(19h)PD(32h)value<CR> as ASCII Value=NONE, IRIG, GPS, PTP/NTP or 1PPS	
Time Ref	PRIORITY List Clear	^YPE	Clears flash list	
Time Ref	PRIORITY List Save	^YPS	Saves to flash	
Time Setting	Set Time Zone	^YTZSHHMM	S = sign: + or – HH = hours; 00- 12 (whole hours only) MM= minutes; 00,15,30,45 Factory default +0000	

Group	Command	String	Variable values	Notes
		^YTZ?	Queries current value Return =(19h)TZ(32h)SHH:MM\<CR> as ASCII Where S=+ or - HH = 0-12, MM=00,15,30, or 45	
Time Setting	Manually Set time	^T (14Hex) yydddhhmmss\<CR>	Where yy is last two digits of the year (00-99) ddd is day of the Julian year (001-365) hh=hours of day (00-23) mm= minutes of the hour (00-59) ss= seconds of the minute (00-59 Time is set by the Time of Day (TOD) clock at start up. Any value set will be overridden when synchronization is achieved with an NTP, PTP, GPS, IRIG Bxx0-3 (not year) or IRIG Bxx04-07 input clock. When using the MJTE as a PTP Master Clock, any use of the manually set time (e.g. 1PPS) must set the time at UTC and not local time.	Set time. Time is entered from left to right, punctuation characters are jumped over, and error checking is done on a character by character basis. Invalid entries are not accepted. If there is an error in the entered value, press the ESC key and try again. When the complete time is entered correctly, press ENTER. The time will be set the moment that the ENTER key is pressed. TIME cannot be set manually if currently locked to GPS, PTP, NTP or an IRIG input signal except the year when locked to an IRIG Bxx0 to IRIG B003 input clock.
	Query Current Time	^T?	Return (14h)TY(32h)*YY:DDD:HH:MM:SS.ssss\<CR> (ascii) where * is lock status (*,N,n,P,p,I,i,S,s,G,g) YY = last two digits of the year DDD= day of year HH= hour of day MM= minutes of hour SS.ssss = seconds.fractional seconds	Samples the current value of the time master on receipt.

Group	Command	String	Variable values	Notes
Time Setting	Leap Second Adjustment	^YTOAnn	Where: 1. A is a constant 2. nn is the current leap seconds value of the range 0 to 99. The value if 37 is in use as of January 1, 2017.	This value is required when operating the MJTE as a PTP Master Clock and it is being synchronized by a 1PPS reference standard. For more information about leap seconds, see 3.5.4 Leap Second Adjust on page 21.
		^YTO?	Queries the current value Return = (19h)TO(32h)A:value<CR> Value = 37 (factory default) or the current leap seconds at the time of shipment.	

5.0 PHYSICAL CHARACTERISTICS

The MJTE is a two-board set preassembled into a PC104 style assembly. The mounting hole placement, board size and connector locations comply with the specifications of PC104 as shown.
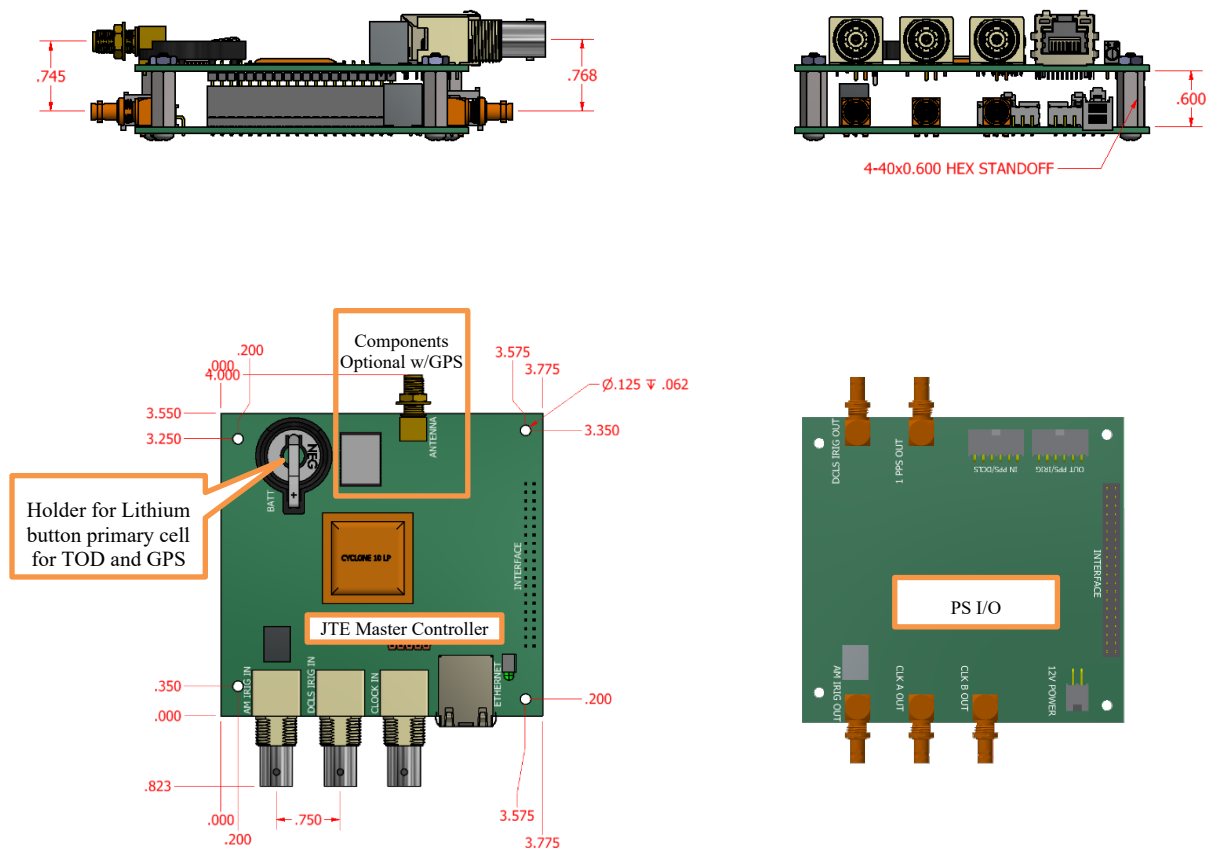
5.1 I/O Connectors

The I/O connectors are identified by name in the images above. Each such connector is identified below specifying the appropriate mating connector.

I/O Connector	Type	Where	Mate
AM IRIG in, IRIG DCLS in, CLOCK in	BNC (3)	JTE Master Controller	
GPS (optional)	SMA		
PTP/NTP	RJ45		
1PPS (out) (SI), IRIG DCLS (out) (SI), IRIG AM (out), Clock 1 (B), Clock 2 (A)	HDBNC 75Ω (5)	PS I/O	HDBNC 75Ω
12 VDC in	SAMTEC 4-pin IPL1-102-01-L-D-RA-K		SAMTEC IPD1-02-D-K
1PPS, DCLS OUT (differential), 1PPS, DCLS in (differential)	SAMTEC 6-pin (2) IPL1-106-01-L-S-RA-K		SAMTEC IPD1-06-S-K

Pin outs of certain connectors are shown below

5.1.1 J3 Differential Inputs, PS I/O board
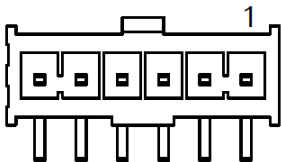
DIFFERENTIAL INPUTS J3	
1	1PPS_IN
2	n/1PPS_IN
3	GROUND
4	GROUND
5	DCLS_IN
6	n/DCLS_IN

5.1.2 J4 Differential Outputs, PS I/O board
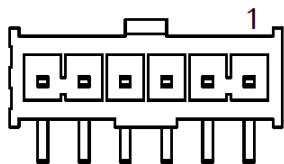
DIFFERENTIAL OUPUTS J4	
1	1PPS_OUT
2	n/1PPS_OUT
3	GROUND
4	GROUND
5	DCLS_OUT
6	n/DCLS_OUT

5.1.3 J9 Power Connector, PS I/O board
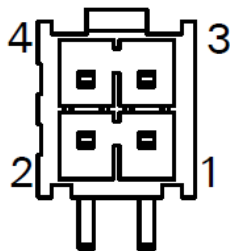
POWER J9	
1	GROUND
2	GROUND
3	+12VDC
4	+12VDC

5.2   Switches and Indicators

The JTE Master Controller has several controls and indicators that are used to set conditions and report running status.

S2: Reset IP address to default, reset NTP address to default, use static IP address. Press at power up to actuate

S3: Use DHCP IP value
Press at power up to actuate

S4: Enter System Test mode as start
Press at power up to actuate

S5 press & hold at any time to restore factory defaults

RTOS task running indicators
CR1=Processor
CR2=Ethernet Stack
CR3=NTP
CR4=PTP

Startup Status
Config done= FPGA HW load OK
Init Done=FW load OK

Hardware reset

CR6 Selected
(TCP/IP port open

CR5 Link Activity

Ethernet Activity

Orange = com@1Gig/s
Green = com@ 100 Mb/s

6.0 SPECIFICATIONS

Function	Parameter	Specification	Notes
Time Master	Unlocked Drift	±36 µS/hour	After 1 hour of continuous operation locked to a time reference.
	Locked to IRIG B12x	750±250 nanoseconds	B120 and B123 do not include the year which must be manually set.
	Locked to IRIG B00x	150 ±50 nanoseconds	B002 and B003 do not include the year which must be manually set.
	Locked to 1PPS	75 ±50 nanoseconds of the 1PPS leading edge	No date or time information is provided by this input. The date, YY.DDD,HH, MM, SS must be set at least once after lock between a 1 second ticks.
	Locked to NTP	250±250 nanoseconds if directly connected to the NTP server. 2µS to 30 milliseconds	Depends on the physical location of the server (LAN or WAN) and how many nodes exist between it and the MJTE
	Locked to PTP (Factory default)	125±50 nanoseconds	This specification presumes that all nodes in the network from the master clock to the MJTE are PTP aware devices compliant with IEEE1588. When chosen as the preferred time reference the MJTE listens and attempts to connect to a network PTP Master Clock. This mode is mutually exclusive to PTP Master Clock mode.
PTP Master Clock		30±25 nanoseconds when synchronized by the optional GPS clock.	This mode is mutually exclusive to the PTP and NTP Clock Synchronization mode. Accuracy depends on an available transfer standard. When the optional GPS receiver is integrated into the MJTE, the PTP master clock will provide messaging that is capable of synchronizing PTP boundary clocks and terminal devices to within 30±25 nanoseconds of the reference clock in operation (IRIG B, 1PPS or optional GPS).

Function	Parameter	Specification	Notes
IRIG B12x Input			AM modulated time code stream is a transformer isolated, 600 Ω input impedance. Synchronization to this input is highly dependent on the signal quality, p-p amplitude of the carrier at the destination and accuracy of the receiving time code decoder. If B120-123 is applied, the YYYY value must be entered manually and between 1 second ticks.
IRIG B00x Input			DC level shifted (DCLS) TTL time code stream is shall be a TTL compatible input having an output impedance of 50Ω. MJTE will attempt to synchronize the time master rollover to the one second marker within 300 ±150 nanoseconds when chosen as the preferred time reference. If B000 to B003 is applied, the YYYY value must be entered manually and between 1 second ticks. This input can be configured to accept either a single ended or differentially driven input. The MJTE can be configured to synchronize to the rising or falling edge of the time markers
1PPS Input			This input shall be a TLL pulse per second stream where the pulse width shall be not less than 10 μsec and no more than 500 μsec. The synchronization may be programmed to align to the rising or falling edge of the 1PPS input. This input can be configured to accept either a single ended or differentially driven input. The MJTE can be configured to align to the 1PPS or the inverted 1PPS signal.
Optional GPS Receiver			A GPS receiver may be purchased that will track up to 12 satellites and provide weeks, hours, minutes, seconds and 1PPS data for use by the MJTE.
IRIG B127 out			Time code transformer isolated, 600 Ω output impedance. Drives up to 100 meters of 50Ω coax. The output is adjustable (programmable) form 1-9.9 Vp-p output. Time code is compliant with IRIG B127.
IRIG B 007 out			Time code is compliant with IRIG B007. One second marker is coincident with the time master ±30 nanoseconds. Drives up to 10 TTL loads up to 100 meters over 50Ω coax. Physical output is configurable to be single ended or differential drive and deliver pulses with the rising or falling edge coincident with the time master one second rollover.

Function	Parameter	Specification	Notes
1PPS out			Phased locked such that the leading edge of the clock will align to the fractional second rollover (1 second tick) to ±25 nanoseconds.
			Drives up to 10 TTL loads up to 100 meters over 50Ω coax. Physical output is configurable to be single ended or differential drive and deliver pulses with the rising or falling edge coincident with the time master one second rollover.
Clocks out	Clock A		Programable from 1 Hz to 10 MHz in decade steps. Phase locked such that the leading edge of the clock will align to the fractional second rollover (1 second tick) to ±25 nanoseconds. Drives up to 10 TTL loads up to 100 meters over 50Ω coax. The output is independently configurable to deliver pulses with the rising or falling edge coincident with the time master one second rollover.
	Clock B		Programmable to 1Hz 1000 Hz in 1 Hz steps. Phase locked such that the leading edge of the clock will align to the fractional second rollover (1 second tick) to ±25 nanoseconds. Drives up to 10 TTL loads up to 100 meters over 50Ω coax. The output is independently configurable to deliver pulses with the rising or falling edge coincident with the time master one second rollover.
Ethernet I/O			RJ45 interface. Negotiates 100/1000 base-T communication rates. Can be set to a fixed or DHCP address.
Controls & Indicators			See 5.2 Switches and Indicators page 36
Temperature			-30°C to 70°ambient
Humidity			95% non-condensing
Power			J9 12 VDC ±10%, 4 Watts
Package			PC 104 board pair. See 5.0 Physical Characteristics page 33