
Introduction

This document describes the key features, hardware, and the installation process of PTP Translator.

Warranty

For terms and conditions of Microchip's warranty, see the website: www.microchip.com.



This product is designed to comply with the limits for a Class A digital device pursuant to Part 15 of FCC rules. These limits are designed to provide reasonable protection against such interference when operating in a commercial environment.

Note: The information in this manual may change without notice. The manufacturer assumes no responsibility for any errors that may appear in this manual.

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1. Product Overview

The PTP Translator converts IEEE® 1588-2008 (PTPv2) messages into legacy time codes including IRIG-B, DCF77, user-defined pulses, and serial strings as well as NTP server messages. PTP Translator can also accept an SNTP signal as an input, allowing synchronization from an SNTP source.

PTP Translator clips onto a standard DIN rail. Its rugged compact design is suitable for noisy electrical environments, while built in electrical isolation combined with strong push-pull drives on outputs simplifying wiring schemes and enhancing reliability.

PTP Translator supports the following PTP profiles:

- Peer to Peer Default Profile
- End to End Default Profile
- IEEE® C37.238-2011 Power Profile
- IEEE® C37.238-2017 Power Profile
- ITU-T G.8275.1 Telecom Profile
- ITU-T G.8265.1 Telecom Profile
- IEC 61850-9-3 Power Utility Profile

Figure 1-1. PTP Translator Front View



2. LED Indicators

The top of the PTP Translator has two LED indicators. The **SYN LED** shows synchronization status, while the **ALM LED** shows the alarm status of the unit. Outputs are synchronized to UTC time only when the SYN LED is fully illuminated.

The following tables provide information regarding the interpretation of the LEDs.

Table 2-1. SYN LED Functionality

| SYN LED | Meaning |
|---------------------------------------|--|
| OFF | No power |
| Slow Flash (1x flash per second) | Either operates in the “holdover” state (holdover timer is running) or operates in the “tuning” state (time server is gaining synchronization) |
| Fast Flash (5x flashes per second) | Not synchronized (out of sync and not in holdover) |
| ON | Synchronized |

Table 2-2. ALM LED Functionality

| ALM LED | Meaning |
|---------------------------------------|---|
| OFF | Operates normally and has no alarms. |
| Fast Flash (5x flashes per second) | At least one alarm is active. See the alarm window in the Clock tab of the Configuration Tool to find the name of the active alarm(s). For details on each alarm by name, see Table 2-3 . |

Table 2-3. Alarm Specification

| Alarm Name | Specification |
|--------------------------|---|
| No Sync | The PTP Translator is not synchronized to an external time source, or the holdover period has expired and/or the maximum inaccuracy threshold has been reached |
| Holdover | PTP Translator has lost synchronization to an external time source and is now in holdover. |
| Factory Reset Armed | This alarm is generated if the Forgotten Password Reset (Factory Reset Process) is enabled and initiated by the user. |
| ADMIN/ETH1 Address Fault | This alarm comes up when a DHCP server is unavailable or when the IP address is assigned to some other node in the network and cannot be assigned to the PTP Translator Ethernet port. Under such situations, the Ethernet port defaults to a link local address. |
| Sync Forced | This alarm is generated when the “Never leave Sync (Test Mode)” option is selected. |

3. Inputs and Outputs

3.1. ETH: Ethernet Port (ST Fiber / RJ-45)

PTP Translator units are fitted with either an RJ-45 10/100 Mbps Ethernet interface or an ST multi-mode Fiber 100BASE-FX Ethernet interface. The unit can be configured over the LAN (Local Area Network) and can be loaded with an NTP/SNTP License.

Next to the Ethernet connector are two LEDs: The green **LNK** LED (above), and the yellow **ACT** LED (below). The LNK LED is ON when the unit is connected to a valid Ethernet port whilst the ACT LED remains ON/flashing when there is activity on either the transmit or receive pair on the Ethernet port.

3.2. TX: Fiber Output

This port transmits an IRIG-B (B00x or B22x), programmable pulse or DCF77 signal over fiber, that might be configured to output in either inverted or non-inverted polarity. The fiber transmitter is compatible with 50/125 μm , 62.5/125 μm , and 100/140 μm multimode glass fiber.

3.3. TTL: TTL Output

The TTL output is a high drive, non-isolated TTL level driver that can be configured using Microchip's Configuration Tool. This port transmits an IRIG-B (B00x or B22x), programmable pulse, or DCF77 signal using 0–5 Vdc TTL level on pins "+" and "-" of the screw terminal connector. The default output is an un-modulated IRIG-B signal (IRIG-B004 with C37.118.1 extensions). It can be used as the source signal to drive one or many downstream devices. The IRIG-B timing pulses (both leading and trailing edges) from this port is typically to within 100 ns of UTC.

This port is a programmable TTL level output that might be configured to output in either inverted or non-inverted polarity:

- A configurable number of pulses per second, minute, hour, day with adjustable pulse-width and offset.
- IRIG-B time code (Un-modulated DCLS or Modified Manchester) with option C37.118.1 or AFNOR extensions.
- Simulated DCF77 receiver time code.

3.4. ALM: Alarm Output

The alarm output is a type "A" (normally open) isolated dry contact type capable of switching up to 250V at 100 mA.

Note: The "Normally-Open" (NO) descriptor refers to the de-energized state of the relay.

PTP Translator operates with the alarm relays energized during normal operation and de-energized in the alarm state. It follows that, in the event of all power to PTP Translator being lost, the alarm relay defaults to the "Alarm" state (open contact). The "+" and "-" symbols are included for reference purposes only, as the alarm contacts are not polarized.

The "ALM" output is a synchronization fail alarm. This alarm is active (contact open) when the unit is not synchronized and is not in the "Holdover" state.

3.5. OPT: Optional Output

PTP Translator has a slot for one I/O card to allow a variety of user interfaces. Each card is limited to one additional port with at least 3 kV isolation from the rest of the system to avoid current loops. See [Table 7-2](#) for the list of orderable options.

4. Software

Configuration Tool

PTP Translator can be configured through Ethernet. The configuration tool can be downloaded from the Microchip Support website at www.microchip.com/myMicrochip/#/. By default, the unit is shipped with DHCP enabled for automatic IP address assignment, with a fall back to link local addressing (169.254.xxx.xxx) if no DHCP server is present.

Default Username: admin

Default Password: Password

Note: You are required to change the default password on your first login.

5. Installation

Identification

Each PTP Translator unit is shipped with an identification label on the side of the case. The label provides details of the optional output (if any), the power supply fitted into the unit, and the unit's serial number.



CAUTION Check the identification label on the side of the unit to ensure that the correct order code and voltage range has been supplied before proceeding with the installation.



CAUTION The label on the side of PTP Translator contains the voltage range. Do not apply power outside of this range.

5.1. Location



WARNING The unit is intended for installation in restricted access areas. Restricted access area must only be accessed using a lock and key or other means of security. Installation must be done only by a qualified professional.

5.2. Power Supply

DC power must be applied to the "+" and "-" screw clamp terminals above the "PWR" input. The DC polarity is not critical. As shown in the following figure, the input voltage range can be found on the side of the unit, above the power input screw clamp terminals.

Note: The Power supply has polarity protection built-in to prevent damage.



CAUTION The input voltage range is marked on the product label on the side of the unit, and on a label above the "+" and "-" screw clamp terminals on the power input. Do not apply voltage outside the range noted.



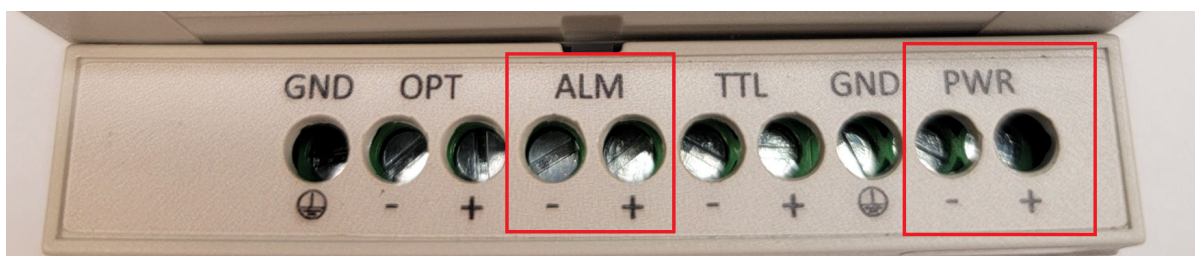
CAUTION The label on the side of PTP Translator indicates the type of output Option Card fitted. Do not apply voltages to output only interfaces.

Figure 5-1. Power Supply Voltage Input Label Above PWR Screw Clamps



5.3. Hazardous Voltage

Figure 5-2. PWR and ALM Screw Clamp Terminals



Up to 250V might be present at the power input port "PWR". Up to 250V might be present at the alarm relay port "ALM" (as shown in the preceding figure). These voltages are supplied to the unit only and not generated by the unit. However, the installer must exercise care in wiring the screw clamps to ensure that the bare copper is not accessible.

5.4. Earthing

Two GND connections are located next to the power supply input terminals and on the left most input terminal (highlighted as in the following figure). The connection next to the power supply must be connected to the rack or cabinet's earth to protect PTP Translator. The secondary input next to the OPT outputs may be used for earthing a cable's shielding.

Figure 5-3. GND Screw Clamp



The unit must be safety earthed whenever it is powered ON using one of the earth terminals as pictured in the preceding figure. The cable cross section must be equal to or greater than 0.2 mm² (30 AWG).

5.5. Mounting the PTP Translator

PTP Translator is designed to be mounted to a standard "Top Hat" din rail mount using the supplied clips on the base (as shown in the following figure). The clips can also be used to screw mount the unit by extending them beyond the case edge.

Figure 5-4. Base of PTP Translator



5.6. Connecting PTP Translator

PTP Translator has a RJ-45/100Base FX connector, ST Fiber output at the top, and a row of rising clamp screw terminals at the bottom. Any connection not required might be left unterminated. The screw terminals are designed for the following cables:

- 0.2-4.0 mm² (30 – 12 AWG) solid cable
- 0.2-2.5 mm² (30 – 14 AWG) stranded cable

The Fiber PTP Translator has a dual ST Fiber connector for the Ethernet and is labeled as **ETH** on the case whereas the IRIG-B fiber out is simply labeled as **TX**.

The connections from left to right along the bottom are:

- Optional output (**OPT**) '+' and '-'

- Alarm (**ALM**) '+' and '-'
- TTL '+' and '-'
- Ground
- Power Supply Negative
- Power Supply Positive

If the optional output is not fitted, then the unused terminals are covered.

Figure 5-5. PTP Translator Top Connectors

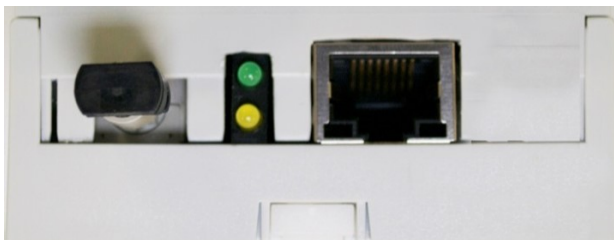
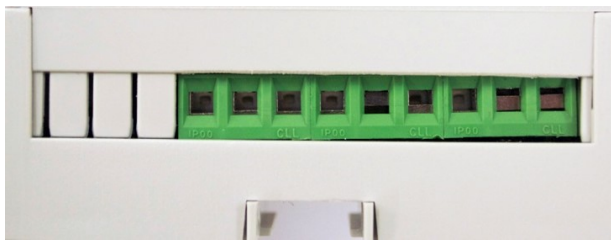


Figure 5-6. PTP Translator Bottom Connectors



6. Factory Reset

PTP Translator features the ability to reset to factory default settings in the event that the administrator password is forgotten, or if the time server is rendered unreachable on the network due to incorrect settings, provided that physical access to the unit is available.

This feature is disabled by default to maximize security and must be enabled through the Microchip Configuration Tool before it can be used. When disabled, there is no method to gain full access to the unit without the administrator password, and if the administrator password is forgotten, the unit must be returned to Microchip for reprogramming at the customer's expense.

For further details on this feature, see the Configuration Tool Manual, which can be downloaded from the Microchip website at www.microchip.com/myMicrochip/#/.

7. Factory Hardware Options

Power Supply Options

There are three different power supply options available for the PTP Translator, detailed in the following table. Low, medium, or high voltage power supplies are available and feature similar maximum output ratings but different levels of isolation.

Table 7-1. PTP Translator Orderable Power Supply Modules

| Power Supply | Input Voltage Ratings | Maximum Power Rating | Isolation |
|--------------|-----------------------|----------------------|-----------|
| Low | 14 – 36 Vdc | 4W | 1.6 kV |
| Medium | 20 – 75 Vdc | 4W | 1.6 kV |
| High | 90 – 250 Vdc | 4W | 3.75 kV |

7.1. Optional Output Cards

PTP Translator has a slot for one I/O card to allow a variety of user interfaces. Each card is limited to one additional port with at least 3 kV isolation from the rest of the system to avoid current loops.

The following table lists the orderable options:

Table 7-2. PTP Translator Orderable Interface Modules

| Output Type | Features |
|-------------|--|
| None | No optional output |
| TTL | TTL (5V, 150 mA) IRIG-B (B00x, B22x), DCF77 or user-defined pulse output |
| Serial | RS232 level (9V, 10 mA) output supporting serial strings |
| AM IRIG-B | Amplitude Modulated (AM) IRIG-B (B12x) signal, typically 8V with 3:1 mark space ratio. Output Impedance 120Ω. Requires a 100–180Ω terminator |

8. Isolation and Protection

The TTL output features an earthed, non-isolated driver and is designed for connection within the same rack. As it is the only output with an earth reference, it is isolated from the power supply through the power supply isolation, and from all other I/O by their isolation. All the other outputs are galvanically isolated (including the optional TTL output card) from the internal electronics and power supply.

The Alarm port has a UL and VDE approved 3.75 kV isolated contact and is protected by a 600V, 175 mA self-resetting fuse and a 350V transient suppressor diode.

The copper Ethernet port provides 1.5 kV isolation and includes Electro-Static Discharge (ESD) suppression on board.

All optional output cards feature at least 3 kV isolation from earth and have ESD suppression suitable for the interface type.

The power supply isolation varies from 1.6 kV for the low and medium voltage power supplies to 3 kV for the high voltage power supply. In addition, a varistor protects the power supply against transverse voltages and transient suppressor diodes protect the internal electronics from longitudinal events.

9. Appendix

Table 9-1. PTP Translator Specifications

| Physical Specifications | | | | |
|--|--|-----------------------|--------------------------|--|
| UL94-V0 polycarbonate flame retardant DIN rail enclosure with IP40 (Ingress Protection rating) | | | | |
| Dimensions | Width | 72 mm | | |
| | Depth | 60 mm | | |
| | Height | 90 mm | | |
| Weight | | 0.15 kg | | |
| Input and Output Specifications | | | | |
| TTL | 5V (4.5V at 150 mA) | 2 Pin | < 100 ns to UTC | |
| Fiber ($\lambda = 820 \text{ nm}$) ¹ | -19 dB optical power | ST | < 100 ns to UTC | |
| Alarm | 250 Vdc, 100 mA | 2 Pin | — | |
| Ethernet (Copper) | | RJ45 | — | |
| Ethernet (Fiber) ¹ | TX: -17 dB optical power RX: -33 dB sensitivity | Dual ST, ½ inch pitch | — | |
| Optional Output Specifications | | | | |
| TTL | 5V (4.5V at 150 mA) | 2 Pin | < 100 ns to UTC | |
| Serial (String) | ± 9V | 2 Pin | < 1 ms to UTC | |
| AM IRIG-B (modulated) | 8V | 2 Pin | < 2 μs to UTC | |
| Environmental Specifications | | | | |
| Operating Temperature Range | | -10 to 65 °C | | |
| Electrical Specifications | | | | |
| Power Supply | Low Voltage | 14–36 Vdc | 2 Pin + common earth | |
| | Medium Voltage | 20–75 Vdc | 2 Pin + common earth | |
| | High Voltage | 90–250 Vdc | 2 Pin + common earth | |
| Power drain | | 4W max | | |

¹ Fiber transmitter is compatible with 50/125 μm , 62.5/125 μm and 100/140 μm multimode glass fiber.

10. Serial Output String (Serial Output Option)

General Key to Fields

Fields between brackets ("`<`" and "`>`") represent ASCII character codes. The used codes are listed as in the following table:

Table 10-1. ASCII Character Codes

| Placeholder | HEX | Content |
|----------------------------|-----|---------------------------------|
| <code><SOH></code> | 01 | ASCII Start of Header character |
| <code><STX></code> | 02 | ASCII Start of Text character |
| <code><ETX></code> | 03 | ASCII End of Text character |
| <code><BEL></code> | 07 | ASCII BEL character |
| <code><LF></code> | 0A | ASCII Line Feed character |
| <code><CR></code> | 0D | ASCII Carriage Return character |
| <code><SPACE></code> | 20 | ASCII Space character |

10.1. NGTS Time Code O/P

The NGTS time code is normally used in conjunction with a 10 ms pulse that finishes precisely on the second. Timing Transmitted once per minute. Sent during the last second before the minute rollover to which the data in the string refers.

- **Timing:** Transmitted once per minute. Sent during the last second before the minute rollover to which the data in the string refers.
- **Default Comms:** 9600 bps, 8-bit ASCII, and no parity
- **Definition:** TyyMMDDWhhmmx<CR><LF>

The following table details the NGTS serial string format and fields:

Table 10-2. NGTS String Time Code Format Fields

| Placeholder | Content |
|-------------------------|---|
| T | "T" |
| yy | Last two digits of the year: e.g., "21" = the year 2021 |
| MM | Month: "00" = January ... "12" = December |
| DD | Day of Month: 01...31 |
| W | Day of week: "1" = Monday ... "7" = Sunday |
| hh | Two-digit hour |
| mm | Two-digit minute |
| x | Time mode: "0" = Local time, "1" = UTC time |
| <code><CR></code> | Carriage Return: HEX 0D |
| <code><LF></code> | Line Feed: HEX 0A |

Example: T020422112340<CR><LF>

Interpretation: Monday 22 April 2002 – 12:34 local time

10.2. IRIG J-17 Time Code O/P

The following table details the IRIG-J17 serial string format and fields:

- **About:** This code is compatible with IRIG Standard 212-00.
- **Timing:** Transmitted once every second. The leading edge of the "start" bit of the first character `<SOH>` is exactly on the second that the message describes.

- **Default Comms:** 9600 bps, 7-bit ASCII, and odd parity.
- **Definition:** <SOH>ddd:hh:mm:ss<CR><LF>

Table 10-3. - IRIG-J17 String Time Code Format Fields

| Placeholder | Content |
|-------------|----------------------------------|
| <SOH> | Start Of Header: HEX 01 |
| ddd | Day of year: range "001" – "366" |
| : | HEX 3A |
| hh | hour: "00" – "23" |
| : | HEX 3A |
| mm | minute: "00" – "59" |
| : | HEX 3A |
| ss | Seconds: "00" – "59" |
| <CR> | Carriage Return: HEX 0D |
| <LF> | Line Feed: HEX 0A |

Example: <SOH>112:12:34:36<CR><LF>

Interpretation: day 112, time 12:34:36

10.3. String-A Time Code O/P

The following table lists the String A serial string format and fields:

- **About:** This code is very similar in data content to the IRIG J-17 code but adds a two-character field containing the year, and uses 8-bit ASCII, no parity data format.
- **Timing:** Transmitted once every second. The leading edge of the "start" bit of the first character <SOH> is exactly on the second that the message describes.
- **Default Comms:** 9600 bps, 8-bit ASCII, and no parity
- **Definition:** <SOH>ddd:hh:mm:ss:yy<CR><LF>

Table 10-4. String A Time Code Format Fields

| Placeholder | Content |
|-------------|---|
| <SOH> | Start Of Header: HEX 01 |
| ddd | Day of Year: range "001" – "366" |
| : | HEX 3A |
| hh | hour: "00" – "23" |
| : | HEX 3A |
| mm | minute: "00" – "59" |
| : | HEX 3A |
| ss | seconds: "00" – "59" |
| : | HEX 3A |
| yy | year: "00" – "99" representing the last two digits of the year since 2000 |
| <CR> | Carriage Return: HEX 0D |
| <LF> | Line Feed: HEX 0A |

Example: <SOH>112:12:34:36:10<CR><LF>

Interpretation: day 112, time 12:34:36, year (20)10

10.4. String-B Time Code O/P

The following table lists the String B serial string format and fields:

- **About:** This code substitutes a “Quality” indicator byte for the year field, but otherwise is identical in form, function, and timing to String-A.
- **Timing:** Transmitted once every second. The leading edge of the “start” bit of the first character <SOH> is exactly on the second that the message describes.
- **Default Comms:** 9600 bps, 8-bit ASCII, no parity
- **Definition:** <SOH>ddd:hh:mm:ssQ<CR><LF>

Table 10-5. String B Time Code Format Fields

| Placeholder | Content |
|-------------|---|
| <SOH> | Start Of Header: HEX 01 |
| ddd | Day of Year: range “001” – “366” |
| : | HEX 3A |
| hh | hour: “00” – “23” |
| : | HEX 3A |
| mm | minute: “00” – “59” |
| : | HEX 3A |
| ss | seconds: “00” – “59” |
| Q | “Quality” Character (detailed in Table 10-6) |
| <CR> | Carriage Return: HEX 0D |
| <LF> | Line Feed: HEX 0A |

Table 10-6. String B Quality Character “Q” Indicators

| “Quality” Character (Q) | | Content |
|-------------------------|-----------------|---|
| HEX | ASCII | |
| 20 | “ ” (space) | Clock is synchronized, timing accuracy is better than 60 ns |
| 2E | “.” (full stop) | Clock is accurate to 1 μ s |
| 2A | “*” | Clock is accurate to 10 μ s |
| 23 | “#” | Clock is accurate to 100 μ s |
| 3F | “?” | Clock accuracy may be worse than 100 μ s |

Example: <SOH>112:12:34:36?<CR><LF>

Interpretation: day 112, time: 12:34:36, >100 μ s sync error

10.5. String-C Time Code O/P

The following table lists the String C serial string format and fields:

- **About:** This code is effectively a combination of String-A and String B. It provides both year information and a sync indicator field.
- **Timing:** Transmitted once every second. The leading edge of the “start” bit of the first character, <CR>, is exactly on the second to which the message data refers.
- **Default Comms:** 9600 bps, 8-bit ASCII, no parity
- **Definition:** <CR><LF>Q<SPACE>yy<SPACE>ddd<SPACE>hh:mm:ss.000<SPACE><SPACE><SPACE>

Table 10-7. String C Time Code Format Fields

| Placeholder | Content |
|-------------|-------------------------|
| <CR> | Carriage Return: HEX 0D |

Table 10-7. String C Time Code Format Fields (continued)

| Placeholder | Content |
|-------------|--|
| <LF> | Line Feed: HEX 0A |
| Q | Quality indicator: ' ' = in-sync, '?' = out-of-sync |
| <SPACE> | HEX 20 (space) |
| yy | Year: "00" – "99" representing the last two digits of the year |
| <SPACE> | HEX 20 (space) |
| ddd | Day of year: range "001" – "366" |
| <SPACE> | HEX 20 (space) |
| hh | hour: "00" – "23" |
| : | HEX 3A |
| mm | minute: "00" – "59" |
| : | HEX 3A |
| ss | seconds: "00" – "59" |
| .000 | ASCII ".000" |
| <SPACE> | HEX 20 (space) |
| <SPACE> | HEX 20 (space) |
| <SPACE> | HEX 20 (space) |

Example: <CR><LF>? 02 112 12:34:36.000

Interpretation: day 112 of year (20)02, time: 12:34:36, out-of-sync

10.6. String-D Time Code O/P

String-D is identical in content to String-B (in [Table 10-5](#)), but the second mark is at the leading edge of the start-bit of the (<CR>).

Example: <SOH>112:12:34:36?<CR><LF>

Interpretation: day 112, time: 12:34:36, >100 μ s sync error

10.7. String-E Time Code O/P

The following table lists the String - serial string format and fields:

- **About:** This provides time, year information, and a sync indicator field.
- **Timing:** The string is transmitted once every second, with the leading edge of the "start" bit of the <CR> exactly on the second.
- **Default Comms:** 9600 bps, 8-bit ASCII, no parity
- **Definition:** <SOH>YYYY:ddd:hh:mm:ssQ<CR><LF>

Table 10-8. String-E Time Code Format Fields

| Placeholder | Content |
|-------------|----------------------------------|
| YYYY | 4-digit current year |
| : | HEX 3A |
| ddd | Day of year: range "001" – "365" |
| : | HEX 3A |
| hh | hour: "00" – "23" |
| : | HEX 3A |

Table 10-8. String-E Time Code Format Fields (continued)

| Placeholder | Content |
|-------------|--|
| mm | minute: "00" – "59" |
| : | HEX 3A |
| ss | seconds: "00" – "59" |
| Q | Quality character, as defined in String B (refer to Table 10-6) |
| <CR> | Carriage Return: HEX 0D |
| <LF> | Line Feed: HEX 0A |

Example: <SOH>2004:112:12:34:36?<CR><LF>

Interpretation: 2004, day 112, 12:34:36pm, >100us sync error

10.8. String-F Time Code O/P

The following table lists the String-F serial string format and fields:

- **About:** This string complies with the protocol required to drive Vorne type Time Displays.
- **Timing:** The string is transmitted once every second, with the leading edge of the "start" bit of the last <BEL> exactly on the second.
- **Default Comms:** 9600 bps, 8-bit ASCII, no parity
- **Definition:**
 <CR><LF>1100<CR><LF>44hhmmss<CR><LF>54ddd<CR><LF><CR><LF>45HHMMss<CR>
 <LF>55DDD<CR><LF><BEL>

Table 10-9. String-F Time Code Format Fields

| Placeholder | Content |
|-------------|--|
| <BEL> | HEX 07 |
| <CR> | Carriage Return: HEX 0D |
| <LF> | Line Feed: HEX 0A |
| 1100 | ASCII "1100" |
| <CR> | Carriage Return: HEX 0D |
| <LF> | Line Feed: HEX 0A |
| 44 | ASCII "44" (means local time follows) |
| hh | Local hour of day: "00" – "23" |
| mm | Local minute of day: "00" – "60" |
| ss | seconds: "00" – "59" |
| 54 | ASCII "54" (means local day of year follows) |
| ddd | Local day of year: "001" – "365" |
| <CR> | Carriage Return: HEX 0D |
| <LF> | Line Feed: HEX 0A |
| 45 | ASCII "45" (means UTC time follows) |
| HH | UTC hour: "00" – "23" |
| MM | UTC minute: "00" – "59" |
| ss | UTC seconds: "00" – "59" |
| <CR> | Carriage Return: HEX 0D |

Table 10-9. String-F Time Code Format Fields (continued)

| Placeholder | Content |
|-------------|--|
| <LF> | Line Feed: HEX 0A |
| 55 | ASCII "55" (means UTC Day of year follows) |
| DDD | UTC Day of year: "001" – "365" |
| <CR> | Carriage Return: HEX 0D |
| <LF> | Line Feed: HEX 0A |
| <BEL> | HEX 07 |

10.9. String-G Time Code O/P

The following table lists the String-G serial string format and fields:

- **About:** This general time string is used predominantly in Europe.
- **Timing:** The string is transmitted once every second, with the leading edge of the "start" bit of the last <ETX> exactly on the second.
- **Default Comms:** 9600 bps, 8-bit ASCII, and no parity
- **Definition:** <STX>swhhmmsDDMMyy<LF><CR> <ETX>

Table 10-10. String-G Time Code Format Fields

| Placeholder | Content |
|-------------|--|
| <STX> | Start of Text: HEX 02 |
| S | Clock Status (refer to Table 10-11) |
| W | Day of Week (refer to Table 10-12) |
| Hh | hour of day: "00" – "23" |
| Mm | minute of day: "00" – "60" |
| Ss | seconds: "00" – "59" |
| DD | day of month: "01" – "31" |
| MM | month of year: "01" – "12" |
| yy | year: "10" – "99" |
| <LF> | Line Feed: HEX 0A |
| <CR> | Carriage Return: HEX 0D |
| <ETX> | End of Text: HEX 03 |

Table 10-11. -String-G Clock Status Indicators

| Clock Status | | | | | |
|---|---|---|---|---|--|
| The s "Clock Status" is an ASCII character in the range 0-9, A-F representing a single hex digit (nibble) | | | | | |
| Bits | 3 | 2 | 1 | 0 | |
| | | | | 0 | No announcement for time change |
| | | | | 1 | Announcement for time change – active for an hour before |
| | | | 0 | | Local Standard Time (LST) |
| | | | 1 | | Daylight Saving Time (DST) |
| | 0 | 0 | | | Time/date invalid – clock is out of sync |
| | 0 | 1 | | | Hold-over mode – running on local Oscillator |
| | 1 | 0 | | | GPS / IRIGB controlled mode |

| | | | | |
|---|---|--|--|---|
| 1 | 1 | | | GPS / IRIGB controlled mode (high accuracy) |
|---|---|--|--|---|

Table 10-12. String-G Day of Week Indicators

| Day of Week | | | | |
|---|---|---|---|------------|
| The w "Day of Week" is an ASCII character in the range 1-7, 9, A-F representing a single hex digit (nibble) | | | | |
| Bits | 3 | 2 | 1 | 0 |
| | 0 | | | Local Time |
| | 1 | | | UTC time |
| | | 0 | 0 | 1 |
| | | 0 | 1 | 0 |
| | | 0 | 1 | 1 |
| | | 1 | 0 | 0 |
| | | 1 | 0 | 1 |
| | | 1 | 1 | 0 |
| | | 1 | 1 | 1 |

Example: <STX>E3123456170410<LF><CR><ETX>

Interpretation: High Accuracy Mode, DST, Wed, 12:34:56, 17/4/2010

10.10. String-H Time Code O/P

The following table details the String H serial string format and fields.

- **About:** This provides time and date information, and sync indicator fields.
- **Timing:** Transmitted once every second. The leading edge of the "Start" bit of the first character <STX> is exactly on the second that the message describes.
- **Default Comms:** 9600 bps, 8-bit ASCII, and no parity
- **Definition:** <STX>D:dd.MM.yy;T:w;U:hh.mm.ss;uvxy<ETX>

Table 10-13. String-H Time Code Format Fields

| Placeholder | Content |
|-------------|--|
| <STX> | Start of Text: HEX 02 |
| D | ASCII "D" |
| : | HEX 3A |
| dd | Day of month: "01" - "31" |
| . | HEX 2E |
| MM | Month of year: "01" - "12" |
| . | HEX 2E |
| yy | Year: "10" - "99" |
| ; | HEX 3B |
| T | ASCII "T" |
| : | HEX 3A |
| w | Day of week: "1" - "7", where "1" = Monday |
| ; | HEX 3B |
| U | ASCII "U" |
| : | HEX 3A |

Table 10-13. String-H Time Code Format Fields (continued)

| Placeholder | Content |
|-------------|--|
| hh | Hour: "00" – "23" |
| . | HEX 2E |
| mm | Minute: "00" – "59" |
| . | HEX 2E |
| ss | Seconds: "00" – "59" |
| ; | HEX 3B |
| u | ASCII '#' if out of sync or <SPACE> (HEX 20) if in sync |
| v | ASCII '*' if out of sync or <SPACE> (HEX 20) if in sync |
| x | ASCII 'U' if UTC time, ASCII "S" if DST, or <SPACE> (HEX 20) if standard time |
| y | ASCII '!' if DST change pending, ASCII "A" if leap second pending, or <SPACE> (HEX 20) otherwise |
| <ETX> | End of Text: HEX 03 |

Example:

```
<STX>D:17.04.10;T:6;U:12.34.56;#*S!<ETX>
```

Interpretation:

17/4/2010, Sat, 12:34:56, out of sync, DST, DST change pending

10.11. NMEA ZDA Time Code O/P

The following table lists the NMEA ZDA serial string format and fields:

- **About:** This string is defined by the NMEA-0183 standard and transmitted at 9600 bps.
- **Timing:** Transmission is once every second. The leading edge of the "start" bit of the "\$" is exactly on the second.
- **Default Comms:** 9600 bps, 8-bit ASCII, and no parity
- **Definition:** \$GPZDA,hhmmss.00,dd,MM,YYYY,s,xx,yy*CC<CR><LF>

Table 10-14. NMEA-ZDA Time Code Format Fields

| Placeholder | Content |
|-------------|---|
| \$GPZDA | ASCII "\$GPZDA" |
| , | ASCII "," (comma) |
| hh | UTC hour of day: "00" – "23" |
| mm | UTC minute of day: "00" – "60" |
| ss | UTC seconds: "00" – "59" |
| .00 | ASCII ".00" |
| , | ASCII "," (comma) |
| dd | UTC day of month: "01" – "31" depending on which month |
| , | ASCII "," (comma) |
| MM | UTC month: "01" – "12", "01" = January |
| , | ASCII "," (comma) |
| YYYY | UTC year, 4 digits. |
| , | ASCII "," (comma) |
| s | Local time zone offset sign (positive means local time leads UTC) |

Table 10-14. NMEA-ZDA Time Code Format Fields (continued)

| Placeholder | Content |
|-------------|---|
| , | ASCII “,” (comma) |
| xx | Local time zone offset from UTC in hours |
| , | ASCII “,” (comma) |
| yy | Local time zone offset from UTC in minutes |
| * | ASCII “*” |
| CC | 2-digit hex representation of the result of XORing the 8 data bits of each character between, but not including the “\$” and “*”. (00-FF) |
| <CR> | Carriage Return: HEX 0D |
| <LF> | Line Feed: HEX 0A |

Example: \$GPZDA,123456.0023042010+1200* UTC time is 12:34:56

Interpretation: 23 April 2010, the local time offset is +12:00

10.12. NMEA RMC Time Code O/P

The following table lists the NMEA ZDA serial string format and fields:

- **About:** This string is defined by the NMEA-0183 standard and transmitted at 9600 bps.
- **Timing:** Transmission is once every second. The leading edge of the “start” bit of the “\$” is exactly on the second.
- **Comms:** 9600 bps, 8-bit ASCII, and no parity
- **Definition:** \$GPRMC,hhmmss.00,a,tttt.tttt,N,ggggg.gggg,W,0.0,0.0,ddmmyy,0.0,E*CC<CR><LF >

Table 10-15. NMEA-RMC Time Code Format Fields

| Placeholder | Content |
|-------------|--|
| \$GPRMC | ASCII “\$GPRMC” |
| , | ASCII “,” (comma) |
| hh | UTC hour of day: “00” – “23” |
| mm | UTC minute of day: “00” – “60” |
| ss | UTC seconds: “00” – “59” |
| .00 | ASCII “.00” |
| , | ASCII “,” (comma) |
| a | Status: “A” = valid, “V” = invalid |
| , | ASCII “,” (comma) |
| tttt.tttt | Latitude (degrees, minutes): “00” – “89” degrees; “00.0000” – “59.9999” minutes |
| , | ASCII “,” (comma) |
| N | Latitude (north/south): “N” = north, “S” = south |
| , | ASCII “,” (comma) |
| ggggg.gggg | Longitude (degrees, minutes): “000” – “180” degrees; “00.0000” – “59.9999” minutes |
| , | ASCII “,” (comma) |
| W | Longitude (east/west): “E” = east, “W” = west |
| , | ASCII “,” (comma) |
| 0.0 | ASCII “0.0” |

Table 10-15. NMEA-RMC Time Code Format Fields (continued)

| Placeholder | Content |
|-------------|---|
| , | ASCII “,” (comma) |
| 0.0 | ASCII “0.0” |
| , | ASCII “,” (comma) |
| dd | UTC day of month |
| mm | UTC month |
| yy | 2-digit UTC year |
| , | ASCII “,” (comma) |
| 0.0 | ASCII “0.0” |
| , | ASCII “,” (comma) |
| E* | ASCII “E*” |
| CC | 2-digit hex representation of the result of XORing the 8 data bits of each character between, but not including the “\$” and “*”. |
| <CR> | Carriage Return: HEX 0D |
| <LF> | Line Feed: HEX 0A |

11. Revision History

The revision history describes the changes that were implemented in the document. The changes are listed by revision, starting with the most current publication.

Table 11-1. Revision History

| Revision | Date | Description |
|----------|--------------|------------------|
| A | October 2025 | Initial Revision |

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