

Redundant Reference Generator with Signal Distributor

Part No: 10354

Functions

- Redundant GPS Receiver
- Redundant Internal Oscillator
- Redundant IRIG Generator
- Reference Signal Distributor
- NTP Server / Client
- Internal Oscillator
 - High Performance OCXO or
 - Disciplined Rubidium
- Optical Link master function to remote slave units *
- Synchronisation as a slave to the Optical Link input with transmission time delay compensation (two way)*

Synchronizes to

- 5 MHz
- 10 MHz

- 1 PPS
- NTP Client**
- Serial Time Code**
- Optical link from master REFGEN-RED*
- GPS

*) Option

**) Time reference only

Generated outputs

- 5 MHz
- 10 MHz
- 100 MHz*
- 1 PPS
- NTP Server
- Serial Time Code
- Optical link to slave REFGEN-RED*
- IRIG

Redundant Reference Generator

REFGEN RED 10354

5 / 10 MHz, 1 PPS, IRIG, GPS receiver, NTP server

TIMETECH



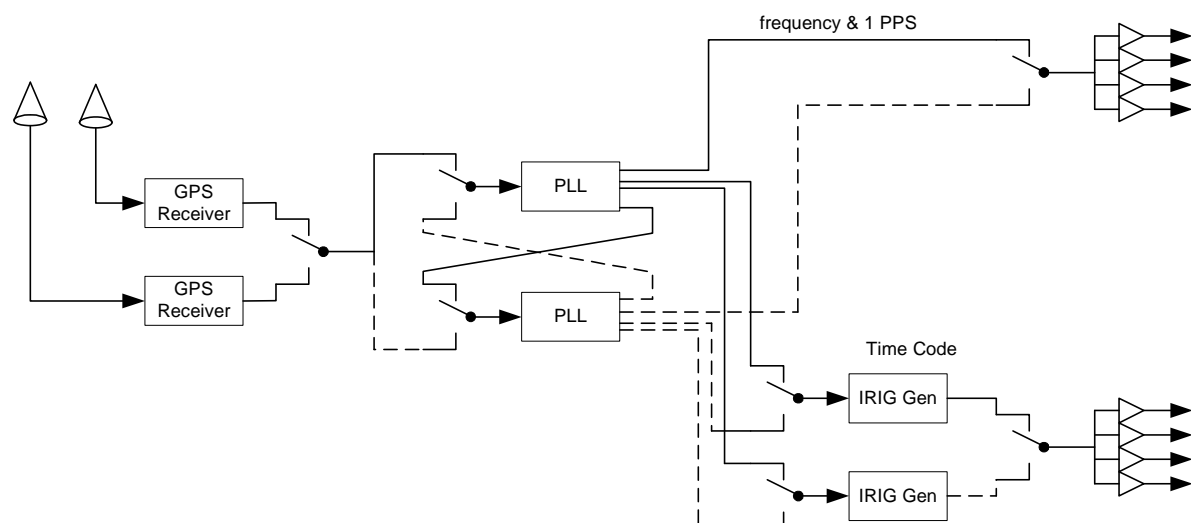
Redundancy Features

The **Redundant Reference Generator with Signal Distributor** (REFGEN-RED) is a generator for generating frequency, pulse and time code reference signals from the GPS reference and for distributing these signals on a large number of output ports.

These functions of the REFGEN-RED are highly available due to the redundant implementation of all essential functions of the unit. In particular these are

- The GPS receiver
- The internal oscillator
- The IRIG generator
- The power supply

The redundancy functions are implemented such that the system can seamlessly change the active / stand-by roles of these redundant modules. The redundant power supply implements the load sharing principle instead of the active / stand-by roles.



29.12.2005 - 10354 - RED 1

Figure 1: REFGEN-RED redundancy architecture

The diagram above shows the redundancy architecture of the REFGEN-RED. One of the both GPS receiver outputs is selected as the active one while the other one is standby. The active GPS output is the time and frequency reference for the REFGEN-RED to generate all internally used reference signals from. It synchronises the PLL of the internal oscillator at 10 MHz and the generation of the 1 PPS internal time reference. One of the redundant oscillators is the master being locked to the GPS reference and the other one is the slave being locked to the output of the master oscillator. The frequency and pulse distribution modules can select either of the both oscillator outputs. In order to maintain coherence of all output signals even in case of internal failures the selectors of all output signal distributor modules are aligned selecting the same source. The same applies to the IRIG generator input signal selector and to the IRIG distributor module selectors.

Oscillator control by GPS

One of the both oscillator modules is active playing the synchronisation master role. Normally the master oscillator is synchronized to the 1 PPS output of the active GPS receiver. The synchronisation control loop implements a rather great time constant in order to effectively filter the jitter being inherent to the GPS

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receiver output signal. The master oscillator generates high stability frequency and 1 PPS signals for feeding the signal distribution modules and for providing a synchronisation reference to the second, i. e. the slave, oscillator.

The oscillator control loop can be disabled, e. g. for maintenance purposes. Then the oscillator is operating in the holdover mode freezing the current oscillator frequency. 'Manual' tuning of the oscillator is possible via a 24 bit DAC.

The second oscillator is the slave oscillator that is synchronised to the output of the master oscillator. This slaving is done with a fast control loop that guaranties a very stable and accurate phase alignment between the master and the slave output signals. This is important for the moment at which the distribution modules are commanded to change their internal redundant input signal selection. The accurate phase alignment causes the switch over to be performed without phase hit.

The both GPS receivers are continuously monitored for their GPS satellite tracking performance. That GPS receiver which has the better tracking performance is declared to be the active GPS receiver. The output of this GPS receiver is used for controlling the master oscillator of the REFGEN-RED. When the GPS tracking performance changes between the both GPS receivers, after some waiting time, the "active" and "stand-by" attributes for the both receivers are interchanged and the oscillator is controlled by the output of the other GPS receiver. This change of the reference is seamless.

Both automatic processes, the active GPS receiver setting and the master/slave oscillator setting, can be overruled by manual interaction. This manual override is needed for preparing the REFGEN-RED for maintenance actions. The stand-by GPS receiver (if it is the GPS-2) and the slave oscillator module can be removed without impact on the performance of the REFGEN-RED. The GPS-1 is on the PC module. Thus removing this causes the oscillator control to be removed as well. For such maintenance action the master oscillator needs to be set to holdover mode first.

Oscillator control by 1 PPS or frequency input

The REFGEN-RED provides two inputs of 1 PPS and one frequency input. The frequency input has automatic detection capability to distinguish 5 MHz and 10 MHz. These inputs can be used to synchronise the REFGEN-RED.

Oscillator master / slave setting

On start-up of the REFGEN-RED one of the both oscillators becomes the master. Once an oscillator module on start-up finds an active master oscillator being present it will become the slave. The master / slave setting changes automatically in case the master oscillator reports any failure or in case the master reference signal to the slave fails.

Reference signal generation and distribution

The oscillator module generates the frequency reference and the 1 PPS reference for signal distribution. The internal reference outputs of the both oscillator modules are connected to the distribution modules and to the both IRIG generator modules. These modules select the reference signal of the master oscillator. In case of failure or in case of manual maintenance command to the REFGEN-RED the slave reference signal will be selected. Such switch-over is controlled and synchronised by the PC module in order to ensure the coherency of all the output signals.

Time code Generation and Outputs

The REFGEN has a redundant IRIG code generator that can generate simultaneously two selected time codes of the following list of codes: IRIG-A, -B, -D, -E; -G, -H; NASA-36, IRIG B 5 MHz. These codes are internally distributed via 4 IRIG channels. In addition to the internal distribution of the IRIG channels the IRIG generator provides 4 IRIG channels at external interfaces.

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Each IRIG distribution module can be configured for external distribution of one of the 4 IRIG channels on four connectors.

The REFGEN-RED has two IRIG generators. Both are configured identically with respect to the IRIG codes being generated on the 4 IRIG channels and with respect to the selection of the frequency reference, the 1 PPS reference (both from the same oscillator module) and the time reference (from the active GPS module). The internal outputs (the 4 IRIG channels) are distributed redundantly to the IRIG distributor modules. All distributor modules select their configured IRIG channel from the active GPS receiver.

Protected and non-protected output signal types

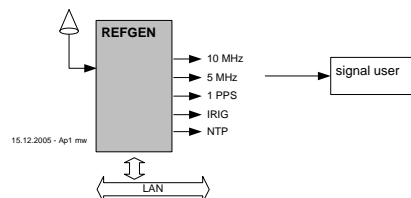
All output signals that are transmitted from a distribution module being able to select between two internal reference signals are called "protected" outputs since their function is protected against a hardware failure within the REFGEN-RED. Protected outputs of 5 MHz, 10 MHz, 100 MHz (option), optical link (option), 1 PPS and IRIG are provided.

In addition to the protected outputs the REFGEN-RED has non-protected outputs from the generator modules, i. e. from the oscillator module and from the IRIG generator module.

REFGEN-RED Applications

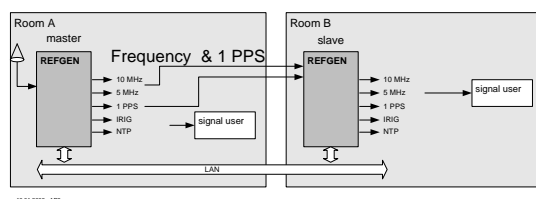
The range of applications for the REFGEN-RED is the same as for the non-redundant REFGEN (product No 10292). These applications are described below.

I Standard GPS based Time & Frequency Generation



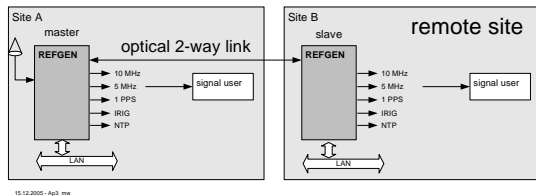
- Generation of time code signals and standard frequency signals from the GPS reference.
- The highly stable internal oscillator allows for extensive averaging of the GPS raw data for generating stable and low jitter output signals.
- In case of loss of the GPS input the internal oscillator provides a stable holdover mode.
- LAN interface for M&C purposes and for NTP server output.

II Intra-Building Distribution



- Time and frequency is transferred to a slave unit in another room.
- References of frequency (5 or 10 MHz) and of 1 PPS transmitted by coax cables to the slave unit.
- Time tag is transferred to the remote site over the LAN via NTP.
- Time offset between master and slave due to transmission delay.

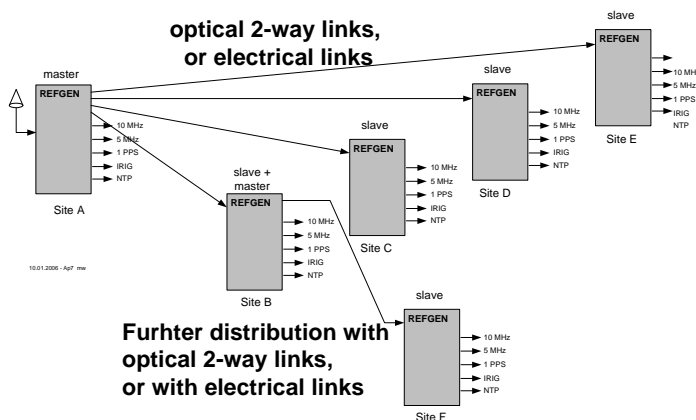
III Optical Link to remote site



Option 4 (optical 2-way interface) required.

- Time and frequency is transferred to a remote site over a distance of up to 2 km.
- The transmission delay is dynamically compensated by the 2-way method. Standard optical cable can be used.
- The optical link signal supports all: frequency, ambiguity resolution, time tag and maintenance signals.
- Single 2-fiber optical cable interconnection. No LAN connection between the sites is required, not even for M&C of the remote site.

IV Distribution to a large number of sites



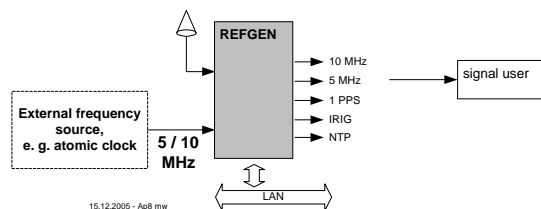
The optical link interface provides 4 optical interfaces for connecting up to 4 remote slave REFGENs to a single master REFGEN. Alternatively and additionally electrical links can be used for slaving remote sites.

Each slave REFGEN can act as a master for further distribution to further slave REFGENs.

This allows for creating virtually an infinite network of REFGENs being located at individual sites.

Option 4 (optical 2-way interface) provides the optical links if required.

V Frequency input from external atomic clock & GPS time reference



- An external frequency input is used for locking the internal oscillator and for generating the internal 1 PPS signal.
- The 1 PPS signal and the time tag of the GPS input are used as time reference.

Use this configuration

- If the GPS reference is not stable enough to serve as frequency reference.
- If the Rubidium option of the REFGEN doesn't have sufficient long term stability.
- If coherence to the external frequency source is required rather than coherence to GPS.

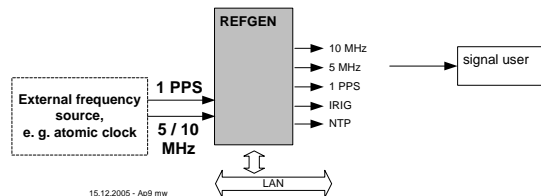
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VI Frequency input from external atomic clock & NTP time reference

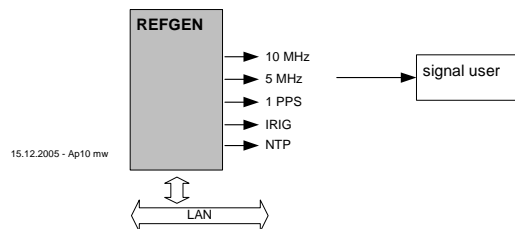


- An external frequency input is used for locking the internal oscillator and for generating the internal 1 PPS signal.
- The time tag of the NTP input is used as time reference on start-up.
- The external source needs to supply a frequency reference and a 1 PPS signal to the REFGEN for start-up 1PPS alignment.

Use this configuration

- If the Rubidium option of the REFGEN doesn't have sufficient long term stability.
- If no GPS reference is available.

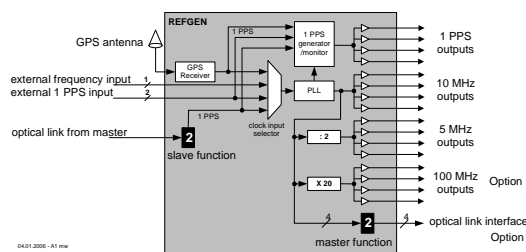
VII Holdover mode operation



- The internal oscillator is the active frequency source and the reference for generation of the internal 1 PPS signal.
- The system time is continued from the previous synchronized state.
- The system time can manually be set for test purposes.

Reference Generator Functions

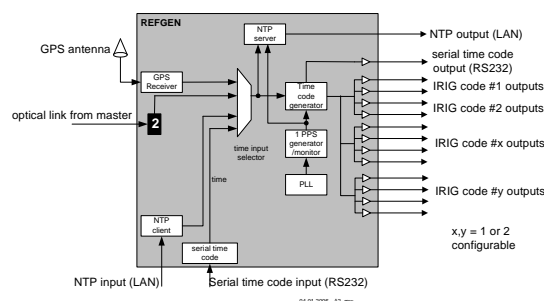
Frequency synchronisation functions



The REFGEN-RED can be configured to lock to one of the following input reference signals for frequency generation:

- GPS 1 PPS
- External frequency input 5 or 10 MHz
- External 1 PPS input
- Optical link from master REFGEN-RED (or non-redundant REFGEN).

Time synchronisation functions



The REFGEN-RED can be configured to synchronise its internal time to one of these sources at start-up

- GPS time reference
- NTP time reference
- Serial time code input
- Optical link from master REFGEN-RED (or non-redundant REFGEN).
- Manual time setting if no other input is available.

System Time

Normally the REFGEN-RED is synchronised to the time reference on start-up of the unit. Afterwards the internal system time is continued by dividing the output frequency of the internal oscillator. The system time

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is monitored against the defined time reference and an alarm is issued if the time offset exceeds the configured threshold.

Time interval counting function

The PC module of the unit has four time interval counters (TICs). In the normal synchronized mode two of these TICs are used for the control loops with the both oscillator modules. The remaining 2 TICs can be used for comparing selected input signals of 1 PPS or 10/5 MHz versus the active oscillator output e. g. for measurement purposes.

NTP interface via TCP/IP

The unit integrates a network interface (LAN) supporting TCP and UDP services. Thus the REFGEN-RED can act as NTP client or as NTP stratum 1 server.

Serial time code output

The serial interface can be programmed to output serial ASCII-style time codes.

Included Peripheral Equipment

- 2 active GPS antennae with cables (30m),
- 2 Hirschmann Stak 20 connectors for self cable mounting for connection to the Stakei 2 DC connector at the unit,
- 2 AC supply cords
- 1 serial interface cable

Controlling the Reference Generator

Local Control

The Reference Generator front panel has a 2 lines 40 characters LCD display and 8 push buttons. This interface allows local control and monitoring of the unit. Especially the IP address of the unit is set via this interface.

Remote Control by Telnet

The Reference Generator allows for remote control via telnet using its TCP/IP port #23.

Alarm Relay

An alarm relay output (contact closed on alarm condition) is provided. The alarm is active when a failure is detected that requires a maintenance action to be done.

Configurable Parameters

The following parameters can be configured either via Local Control or via Telnet. Individual configurations are possible for any type of output, i. e. all 5 MHz outputs show the same behaviour, but the configuration for the 5 MHz outputs and the 10 MHz outputs may be different.

Function	Configurable Parameter	Function	Configurable Parameter
GPS	- Mode of operation - Set active/standby GPS	Oscillator	- Enable/disable the control loop (tracking/holdover) - Regulation offset (time offset versus the input reference) - Change master/slave
IRIG	- Time code channel #n - Amplitude channel #n - Select channel #n for each distribution module (n = 1 .. 4) - Set active/standby IRIG generator	M&C	- Save interval (time interval of regular state reports) - Clear system event record
1 PPS	- Input signal trigger level individually for every interface - Output: amplitude (2 levels)	LAN	- TCP/IP configuration - Remote control enable/disable - Telnet connection enable/disable
Outputs	- Enable/disable(mute) - Set time error threshold for enabling the output - Set auto-muting during holdover		

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TCP Command & Data Output Interface, and Serial Interface

The Reference Generator supports a management and control interface (M&C) on its TCP/IP ports #2000 and #2001. The same function is also available via a serial RS232 interface. Regularly issued status reports as well as status reports on request are provided. For the data being available for such state reports see the list of monitored parameters below.

UDP Interface

The state reports can be made available also at UDP ports. This allows any external station controller for getting the REFGEN-RED state just by listening to this port.

Monitored Parameters

The Reference Generator monitors all essential states of its internal hardware as well as the states of the inputs signals, the states of the output signals, the state of the internal oscillator control loop, and the states of the time interval counters.

Function	Monitored Parameters	Function	Monitored Parameters
Hardware	- Internal DC voltages - Internal currents - Unit internal temperature	GPS	- Satellites being tracked & C/No - Antenna signal - RAIM - Current position
Outputs	- Signal power - Signal muted	TIC	- Time Interval Counter current values for TIC#1, TIC#2, TIC#3, and TIC#4 - Measurement history
Oscillator	- Control loop offset and status		

IRIG Features

Supported IRIG codes and IRIG channels

Format	IRIG A	IRIG B	(IRIG D)	IRIG E	IRIG G	IRIG H	NASA-36
Bit Rate (ER)	1 kPPS	100 PPS	1 PPM	10 PPS	10 kPPS	1 PPS	100 PPS
Carrier Fr. (F)	10 kHz	1 kHz 1 MHz 5 MHz	100 Hz 1 kHz	100 Hz 1 kHz	100 kHz	100 Hz 1 kHz	1 kHz
Frame Rate	10 FPS (= 100 ER)	1 FPS (= 100 ER)	1 FPH (= 60 ER)	0.1 FPS (= 100 ER)	100 FPS (= 100 ER)	1 FPM (= 60 ER)	1 FPS (= 100 ER)
Ratio F / ER	10 : 1	10 : 1	6000 : 1 60000 : 1	10 : 1 100 : 1	10 : 1	100 : 1 1000 : 1	10 : 1
Binary Zero [cycles / sec]	2 / 0.2 ms	2 / 2 ms	1200 / 12 s 12000 / 12 s	2 / 20 ms 20 / 20 ms	2 / 20 us	20 / 0.2 s 200 / 0.2 s	2 / 2 ms
Binary One [cycles / sec]	5 / 0.5 ms	5 / 5 ms	3000 / 30 s 30000 / 30 s	5 / 50 ms 50 / 50 ms	5 / 50 us	50 / 0.5 s 500 / 0.5 s	6 / 6 ms
Reference [cycles / sec]	8 / 0.8 ms	8 / 8 ms	4800 / 48 s 48000 / 48 s	8 / 80 ms 80 / 80 ms	8 / 80 us	80 / 0.8 s 800 / 0.8 s	6 / 6 ms
Mark-Space R Nominal/Range	10:3 / 3:1 to 6:1	10:3 / 3:1 to 6:1	10:3 / 3:1 to 6:1	10:3 / 3:1 to 6:1	10:3 / 3:1 to 6:1	10:3 / 3:1 to 6:1	3:1

The table shows the available IRIG codes. In addition to the well known IRIG codes, a IRIG B code with a 5 MHz carrier frequency is available. IRIG codes are output as modulated codes and as DC shift outputs. The IRIG generator supports 4 independent IRIG channels transporting IRIG codes. Each channel can be configured for an individual IRIG code. The generator provides 4 channels with configurable modulation property at external output interfaces and distributes these IRIG channels

internally to the IRIG distributor modules. Each IRIG distributor is configured for distribution of one of these channels providing 4 equal IRIG outputs according to the selected IRIG channel.

Supported IRIG Configurations

OUT	IRIG Generator				IRIG Distributor
	1	2	3	4	1 - 4
IRIG channel 1	X	-	-	-	Select one channel
IRIG channel 2	-	X	-	-	
IRIG channel 3	-	-	X	-	
IRIG channel 4	-	-	-	X	

Additional to the IRIG code configuration each IRIG channel can be configured for

- Modulated format, or DC-shift RS232 format, or DC-shift TTL format
- Amplitude

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Both redundant IRIG generators are configured equal.

The REFGEN-RED provides two types of IRIG outputs, non-protected outputs from the IRIG generator and protected outputs from the IRIG distributors.

Standard Configuration and Options

Standard REFGEN-RED Module Configuration

Slot 0	Slot 1	Slot 2	Slot 3	Slot 4	Slot 5	Slot 6	Slot 7	Slot 8	Slot 9	Slot 10
Input: Panel 1 PPS 1 input	Oscillator Module-1 10MHz 4 outputs	Distributor Module 5 MHz 4 outputs	Distributor Module 5 MHz 4 outputs	Distributor Module 10 MHz 4 outputs	IRIG Generator & Distributor Module 4 outputs	Distributor Module IRIG 4 outputs		PC Module GPS-1 receiver input LAN IF serial IF 1 PPS input 5/10 MHz input	DC/DC Power Input 18-32 V	AC/DC Power Input 90-265 V
	Oscillator Module-2 10MHz 4 outputs	Distributor Module 5 MHz 4 outputs	Distributor Module 5 MHz 4 outputs	Distributor Module 1 PPS 4 outputs	IRIG Generator & Distributor Module 4 outputs	Distributor Module IRIG 4 outputs		Controller Module GPS-2 receiver input Alarm relay IF	DC/DC Power Input 18-32 V	AC/DC Power Input 90-265 V

Protected outputs are printed in **bold** face in this diagram. The generator modules have non-protected outputs being printed in normal face here.

The slot 7 of the REFGEN-RED standard configuration is still unused. It can be equipped with optional distribution modules.

Oscillator options are available on slot#1. The Ultra Low Phase Noise Oscillator output is 5 MHz instead of 10 MHz as for the standard REFGEN-RED, the Rubidium Oscillator output is 10 MHz.

Option	Function	Slot*
1	Ultra Low Phase Noise Oscillator (Oscillator module 5 MHz output, no option slot occupied)	1
2	Rubidium Oscillator (no option slot occupied)	1
3	100 MHz output, 8 outputs	7
4	Optical two-way interface to another REFFGEN (8 x master function + 4 x slave function)	7
5	Additional 5 MHz output, 8 outputs	7
6	Additional IRIG output, 8 outputs	7
7	High Performance Oscillator	1

*) This column indicates the slot that needs a module to be added or changed.

Only a single option occupying the slot 7 can be implemented. An oscillator option can be added in parallel.

Numbers of protected outputs - summary

	5 MHz	10 MHz	100 MHz	1 PPS	IRIG	Optical 2-Way
Standard	16	4	-	4	8	-
Option 1	16	4	-	4	8	-
Option 2	16	4	-	4	8	-
Option 3	16	4	8	4	8	-
Option 4	16	4	-	4	8	8
Option 5	24	4	-	4	8	-
Option 6	16	4	-	4	16	-
Option 7	16	4	-	4	8	-

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Internal Oscillator & Optical 2-Way Performance

Internal Oscillator

Oscillator option		Standard	Option 1	Option 2	Option 7	
			Ultra Low PN	Rubidium	spec	typical*
Osc. frequency		10 MHz	5 MHz	10 MHz	10 MHz	10 MHz
Short term stability	1 s	2×10^{-12}	1.3×10^{-13}	3×10^{-11}	1×10^{-12}	4×10^{-13}
	10 s	3×10^{-12}	8.0×10^{-14}	1×10^{-11}		5×10^{-13}
	100 s			3×10^{-12}		1.1×10^{-12}
Phase noise	1 Hz	- 100 dBc/Hz	- 125 dBc/Hz	- 70 dBc/Hz	- 105 dBc/Hz	
	10 Hz	- 125 dBc/Hz	- 145 dBc/Hz	- 80 dBc/Hz	- 135 dBc/Hz	
	100 Hz	- 140 dBc/Hz	- 153 dBc/Hz	- 115 dBc/Hz	- 145 dBc/Hz	
	1 kHz	- 145 dBc/Hz	- 156 dBc/Hz	- 135 dBc/Hz	- 150 dBc/Hz	
	10 kHz	- 150 dBc/Hz	- 156 dBc/Hz	- 145 dBc/Hz	- 150 dBc/Hz	
Ageing**	per day		2×10^{-11}		5×10^{-10}	
	per month		5×10^{-10}			
	per year	3×10^{-8}	4×10^{-9}	5×10^{-11}	7.5×10^{-8}	

*) In temperature controlled environment, 0.5 Kpp. Active temperature compensation is implemented.

***) The aging performance specification applies after 30 days of continuous operation.

Optical Link

Oscillator option of slave REFGEN-RED

Residual ADEV	Oscillator option of slave REFGEN-RED		
	Standard	Ultra Low PN Option 1	Rubidium Option 2
1 s	1×10^{-12}	2×10^{-13}	3×10^{-11}
10 s	1×10^{-12}	2×10^{-13}	1×10^{-11}
100 s	5×10^{-13}	8×10^{-14}	2×10^{-12}
1 000 s	6×10^{-14}	9×10^{-15}	6×10^{-14}
10 000 s	7×10^{-15}	1×10^{-15}	2×10^{-15}

This specification applies to an optical link length of up to 200 m. All equipment and the optical fibre cable shall be in the temperature range 18 to 24°C with variation max. 1Kpp over one day, slope <0.3K/h. A higher optical link distance than 200 m may cause higher ADEV values due to temperature effects.

Signal Inputs

GPS Input

Number of inputs 2 (1 on the PC module and 1 on the controller module)
GPS receiver 12 channel timing receiver Motorola M12+

Connector

SMA

Frequency Inputs

Number of inputs 1 on PC module
Impedance 50 Ω
Input Level +3 .. +10 dBm
Frequency 5 or 10 MHz, sine wave
Frequency configuration Automatic frequency detection 5/10 MHz
Input return loss > 45 dB

SMA

Pulse Inputs

Number of inputs 2 (1 on PC module and 1 on the slot #0)
Impedance 50 Ω or high impedance,
Input level 1 Vpp .. 5 Vpp
Trigger level Configurable
Signal type 1 PPS

SMA (on PC)
BNC (on slot #0)

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Protected Outputs

Frequency Outputs

5 MHz Protected Output

Number of outputs	16				
Impedance	50 Ω				
Output Level	+12.5 \pm 0.5 dBm				
Output return loss	> 50 dB				
Output / Output Isolation	> 100 (108 typ.) dB				
Harmonics +10 dBm input	-76	-76	-80		dBc
(1 st , 2 nd , 3 rd) +13 dBm input	-73	-69	-82		dBc

Connector

BNC

10 MHz Protected Output

Number of outputs	4				
Impedance	50 Ω				
Output Level	+12.5 \pm 0.5 dBm				
Output return loss	> 50 dB				
Output / Output Isolation	> 90 (100 typ.) dB				
Harmonics +10 dBm input	-70	-57	-65		dBc
(1 st , 2 nd , 3 rd) +13 dBm input	-65	-55	-65		dBc

BNC

100 MHz Signal Output (Option 3)

Number of outputs	8				
Impedance	50 Ω				
Output level	+11.5 \pm 0.5 dBm				
Output return loss	> 30 (-35 typ.) dB				
Output / Output Isolation	> 75 (83 typ.) dB				
Harmonics +10 dBm input	-44	-46	-60		dBc
(1 st , 2 nd , 3 rd) +13 dBm input	-42	-40	-55		dBc

SMA

Pulse Outputs

1 PPS Protected Outputs

Number of outputs	4				
Impedance	50 Ω				
Level	5 / 10 Vpp (unloaded), 2.5 / 5 Vpp (loaded with 50 Ω)				
	Output level is S/W selectable				
Rise / fall times / width	$t_r < 6$ ns, $t_f < 6$ ns, pulse width ~ 20 μ s				

BNC

Time Code Outputs

IRIG Protected Outputs

Number of outputs (std)	8 (2 groups of 4)				
No of outputs (option 6)	16 (4 groups of 4)				
Configurable items	One of 4 IRIG channels is configurable per group. The IRIG channels are generated by the IRIG generator, see below.				
Output impedance	50 Ω (or 600 Ω , select on order)				

BNC

Optical Two-Way Interface (option 4)

Number of interfaces	8	Fiber specification			
Link range	220 m	62.5/125 μ m MMF 160 MHz*km			
	275 m	62.5/125 μ m MMF 200 MHz*km			
	500 m	50/125 μ m MMF 400 MHz*km			
	550 m	50/125 μ m MMF 500 MHz*km			
Eye safety	IEC 60825-1 Class 1/CDRH Class 1				

MT-RJ

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Non-Protected Outputs

Frequency Outputs

5 / 10 MHz Non-protected Output

Number of outputs	8 (4 per oscillator module)	
Impedance	50 Ω	
Output Level	+12.5 \pm 0.5 dBm	
Output return loss	> 50 dB	
Frequency	Standard Oscillator	10 MHz
	Ultra Low Phase Noise Oscillator	5 MHz
	Rubidium Oscillator	10 MHz

Connector

BNC

5 MHz performance

Output / Output Isolation	> 100 (108 typ.) dB				
Harmonics (1 st , 2 nd , 3 rd)	+10 dBm input	-76	-76	-80	dBc
	+13 dBm input	-73	-69	-82	dBc

10 MHz performance

Output / Output Isolation	> 90 (100 typ.) dB				
Harmonics (1 st , 2 nd , 3 rd)	+10 dBm input	-70	-57	-65	dBc
	+13 dBm input	-65	-55	-65	dBc

Pulse Output

1 PPS Non-Protected Output

Number of outputs	1 on the PC module	SMA
Impedance	50 Ω	
Level	5 / 10 Vpp (unloaded), 2.5 / 5 Vpp (loaded with 50 Ω) Output level is S/W selectable	
Rise / fall times / width	$t_r < 6$ ns, $t_f < 6$ ns, pulse width ~ 20 μ s	

Time Code Outputs

IRIG Code Generator (4 Channel Generator)

IRIG codes	IRIG A, B, D, E, G, H, NASA 36, IRIG B 5 MHz
Number of codes	4 independent codes on 4 IRIG channels
Data content	BCD hour, minute, seconds, day of year straight binary seconds, extension field: year
Signal amplitude	Configurable per IRIG channel:
Modulated output	0.3 to 10 Vpp (loaded with 50 Ω)
DC-shift output	RS232 interface spec with +10V/-10V (unloaded), or TTL level (0V/+5V) into 50 Ω load, configurable
Modulated / DC-shift	Configurable per IRIG channel
Code	Configurable per IRIG channel

Non-Protected Outputs from IRIG generator

Number of outputs		BNC
Total	8	
Per IRIG generator	4 (the IRIG channels #1 .. #4 are allocated)	
Signals	As defined for the IRIG generator	
Output impedance	50 Ω (or 600 Ω , select on order)	

Time Code Output

Number of outputs	1 on the PC module	9 pin Sub-D male
Protocol	European Telephone Time code or plain ASCII, configurable	
Level	RS232	

Redundant Reference Generator

REFGEN RED 10354

5 / 10 MHz, 1 PPS, IRIG, GPS receiver, NTP server

TIMETECH



Power Supply, M & C, Mechanical & Environmental Conditions

		Connector																				
Electrical interface	Redundant implementation of the power supply modules																					
Supply voltage DC	18 to 32 V DC	Hirschmann Stakei 2																				
Number of DC inputs	2																					
Supply voltage AC	90 to 265 V AC, 47 to 65 Hz	IEC320																				
Number of AC inputs	2																					
Source selection	Load sharing between AC and DC inputs																					
Power Consumption																						
Total	< 70 W																					
Per input	< 35 Watts on AC, < 30 Watts on DC																					
M & C interface																						
Serial line	RS232	9 pin Sub-D male																				
Protocol	19200 bps 8N1, plain ASCII																					
Availability	If not used for time code input or output.																					
Ethernet	10 Mbit/s twisted pair	RJ45																				
	<table border="1"><thead><tr><th>Service</th><th>Port</th><th>Service</th><th>Port</th></tr></thead><tbody><tr><td>TCP services</td><td>Telnetd</td><td>Data output</td><td>2001</td></tr><tr><td></td><td>Command</td><td></td><td>2000</td></tr><tr><td>UDP services</td><td>Syslog client</td><td>Data output</td><td>Configurable</td></tr><tr><td></td><td>TFTP server</td><td>NTP</td><td>123</td></tr></tbody></table>	Service	Port	Service	Port	TCP services	Telnetd	Data output	2001		Command		2000	UDP services	Syslog client	Data output	Configurable		TFTP server	NTP	123	
Service	Port	Service	Port																			
TCP services	Telnetd	Data output	2001																			
	Command		2000																			
UDP services	Syslog client	Data output	Configurable																			
	TFTP server	NTP	123																			
Alarm relay	Closer contact.	9 pin Sub-D male																				
Front panel																						
Time Display:	Bright red LED 7 segment display, 1" high showing: Day of year, hour, minute, seconds.																					
Control Display:	2 lines, 40 characters LCD display showing: Instrument status & configuration, levels of inputs and outputs, selected input, alarms and messages, event history, active/stand-by state.																					
Push Buttons:	8 function keys giving access to all vital functions such as: Instrument setup & configuration, input and output monitoring, input selection.																					
Alarm LEDs:	ERROR: Any malfunction of the unit POWER: Supply voltage is o.k.	OPER: Processor alive status LOCAL: Remote control state.																				
Mechanical																						
Width, height	19 inch, 4 height units (448.8 mm * 176 mm), rack mountable																					
Depth, weight	depth 448 mm, weight: 12 kg																					
Environmental																						
Transportation and Storage																						
Temperature.	-20°C to +75°C																					
Humidity	10% to 90% (non condensing)																					
Altitude	< 20 000 m																					
Shock	max 10g acceleration for 11 ms																					
Vibration	max. 0.15 mm at 5 to 8 Hz, max 1g acceleration at 8 to 500 Hz																					
Operation																						
Temperature	-10°C to +50°C (option 2 [Rubidium oscillator] limited to +40°C)																					
Humidity	20% to 90% (non condensing)																					
Altitude	< 3 000 m																					