

Cycle F&T System

Frequency & Time Generation and Distribution System

Lowest noise F&T generation and transfer

APPLICATIONS

Frequency and time (F&T) signal generation and distribution for applications such as:

- Space telescope arrays and networks
- UTC time realization and distribution
- Ultra-stable F&T transfer and comparison
- Positioning, navigation and timing

BENEFITS

- Stability better than state-of-the-art masers at RF outputs ($ADEV < 1E-13$ at 1 s)
- Full redundancy & no single point of failure
- **Remote** or **local control** via TCP/IP
- Advanced monitoring and control features



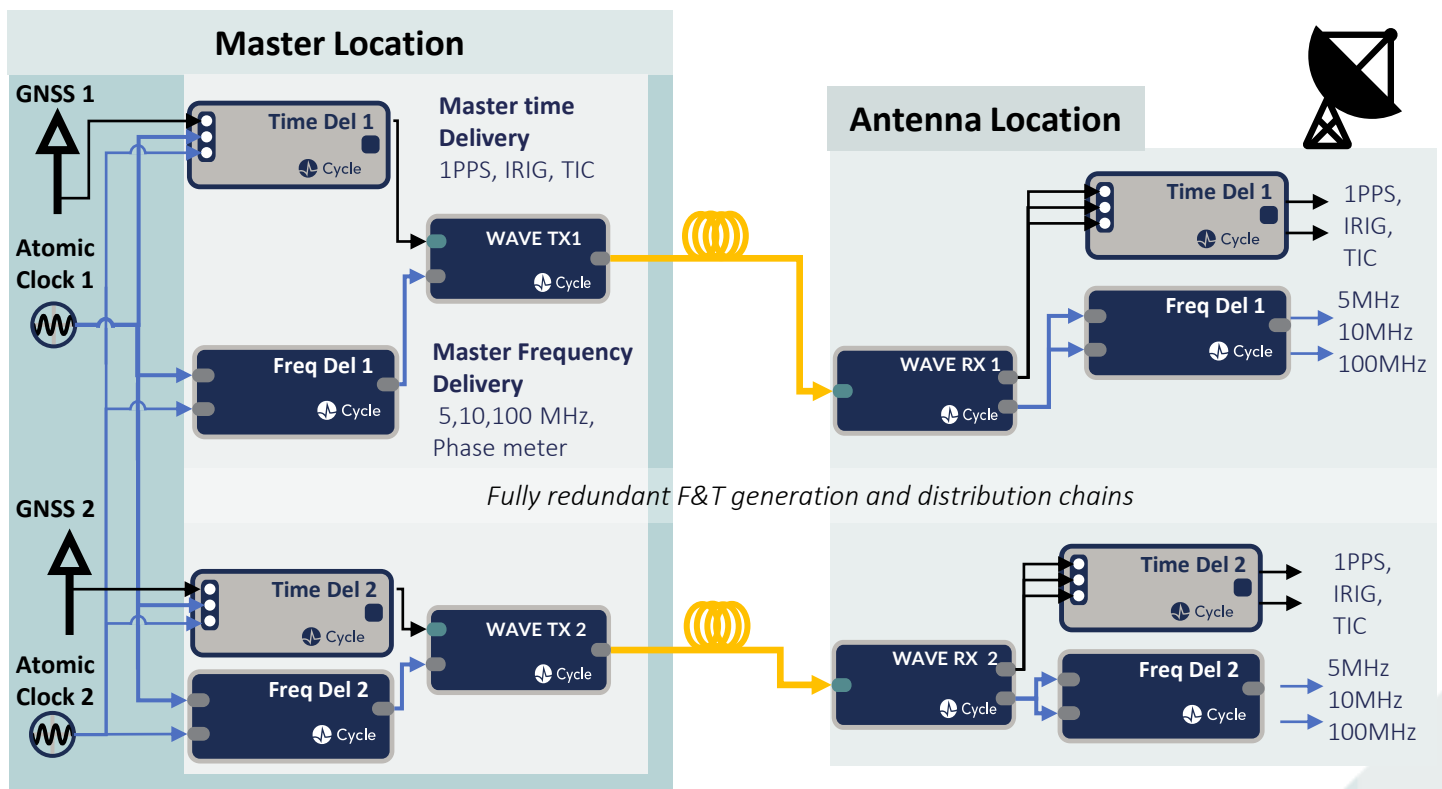
DESCRIPTION

The F&T system comprises of two redundant signal generation and distribution subsystems.

It can house Rubidium or Cesium clocks within the same rack or can alternatively integrate external active Hydrogen maser signals.

If necessary, the F&T signals can be transmitted to multiple remote locations either via phase-stable coaxial cables or via actively stabilized fiber optic links delivering femtosecond-level stability.

Additionally, the system includes redundant GNSS receivers with UTC tracking and referencing, high-resolution time interval counters for precise 1PPS measurements, and phase meters for detailed phase and frequency analysis, enabling real-time performance monitoring.





SPECIFICATIONS

Parameter	Specification	Comment		
Clock input frequency	5 MHz, 10 MHz, 100 MHz & 1 GHz	at [10 – 13 dBm] input power, 3x switchable F&T inputs		
Control system interface	TCP/IP	e.g., EPICS or Telnet		
Dimensions	42U or 47U	19” rack including all necessary F&T generation & distribution modules		
Residual ADEV ¹	Tau	ADEV		
	1 s	< 1.5E-13		
	10 s	< 2.0E-14		
	100 s	< 5.0E-15		
	1 000 s	< 2.0E-15		
	10 000 s	< 2.0E-15		
Phase noise	Offset frequency	10 MHz carrier	100 MHz carrier	1 GHz carrier
	1 Hz	-120 dBc/Hz	-105 dBc/Hz	-90 dBc/Hz
	10 Hz	-135 dBc/Hz	-118 dBc/Hz	-98 dBc/Hz
	100 Hz	-145 dBc/Hz	-127 dBc/Hz	-107 dBc/Hz
	1 000 Hz	-150 dBc/Hz	-153 dBc/Hz	-133 dBc/Hz
	10 000 Hz	-155 dBc/Hz	-165 dBc/Hz	-145 dBc/Hz
	100 000 Hz	-155 dBc/Hz	-165 dBc/Hz	-145 dBc/Hz
1PPS outputs				
Signal level	2.5 V TTL	50 Ω impedance		
Pulse rise and fall times	≤ 1 ns	from 10% to 90% level		
Pulse duration	20 μs – 500 ms	adjustable		
Return loss	30 dB	at signal outputs		
Delay adjustment	10-ns step size	at 100-MHz input		
Timing jitter	< 5 ps RMS	added noise to the clock input		
IRIG outputs				
Timecode	IRIG-B	contact Cycle for more details.		
F&T distribution amplifiers (multiple modules can be added)				
Frequency distribution	2 x 12	2 switchable inputs, 12 outputs per module [5 MHz, 10 MHz & 100 MHz]		
1PPS or IRIG distribution	2 x 10	2 switchable inputs, 10 outputs per module		
Phase/frequency meter				
Input signal	Sine wave	[5 MHz – 100 MHz] frequency and [7 – 10 dBm] power		
Input channels	4 x SMA type	real-time, 1-s rate, all input combinations reported, ch1=REF.		
ADEV measurement floor ¹	Tau	ADEV		
	1 s	< 4.0E-14		
	10 s	< 1.0E-14		
	100 s	< 2.0E-15		
	1 000 s	< 1.0E-15		
	10 000 s	< 1.0E-15		
Time interval counter				
Input signal	1 PPS	2.5 V TTL at 50 Ω impedance		
Input channels	4 x SMA type	real-time, 1-s rate, all input combinations reported.		
Resolution	20 ps RMS			
GNSS tracking & referencing				
GNSS receiver	Furuno GT-100	1x SMA-type, multi-GNSS RX, optional with a GNSS antenna		
Outputs	1PPS & 10 MHz	1x SMA-type each, synchronized UTC time and freq. output		
Requirements				
Fiber link length	< 1 km	contact Cycle for longer fiber links.		
Fiber link loss	< 10 dB	if higher fiber loss, see option H: EDFA.		
Fiber link reflectance	< -40 dB	APC type fiber connectors are recommended.		

¹ F&T rack shall be in a thermally controlled environment (temperature +18 to +24°C, with slope < 0.4°C/h and variation < 1°C pk-pk; humidity < 60 %RH with variation < 10 %RH pk-pk).