



Tomorrow's Telemetry Today!

Da-Tel Research Company, Inc.
932 N. Park Avenue / P. O. Box 1206
Montrose, Colorado 81402
www.da-telresearch.com

Phone: (970) 249-6129
Fax: (970) 249-8919

Email: info@da-telresearch.com

G-7902C TELEMETER FS RECEIVER INSTRUCTION INFORMATION

- CRYSTAL CONTROLLED
- WIDE TEMPERATURE OPERATION
- 0.15% ACCURACY
- INDICATED CARRIER AND MODULATION FAIL OUTPUT
- VOLTAGE OR CURRENT LOOP OUTPUT
- ISOLATED OUTPUT

GENERAL DESCRIPTION

The G-7901D and the G-7902C telemetry system provides higher accuracy and greater temperature stability than conventional telemetering systems. These features stem from the extensive use of crystal stabilized oscillators for frequency synthesis and detection circuits. Typical telemeter converter accuracy is better than 0.1% over a temperature span of 0 to 50 degrees C. Plug-in filter sections are standard.

The G-7902C Telemeter, FS Receiver linearly regenerates a dc voltage or current from sub-audio frequency modulated FS tones. The on-board FS receiver accepts frequency shift tones from a standard voice grade telecommunication channel in the range of 420 Hz to 10 kHz. The input filter of the FS receiver exhibits a 600 ohm rising impedance out of band. Attenuation at adjacent channels is greater than 40 dB allowing the frequency multiplexing of several receivers onto one transmission medium. The FS receiver detects the sub-audio frequency which in turn is discriminated into an analog output by the phase-locked loop section. An integrating amplifier transforms the phase-locked loop feedback voltage to generate the calibrated output voltage.

The output of the telemeter converter section can have spans in the range of 100 mV to 10 V and current loops to 20 mA using an optional driver ampli-



fier. The G-7902C can also be configured to realize sub-audio frequencies other than the standard 10 to 30 Hz such as 5 to 15 Hz, 18 to 30 Hz and 5 to 25 Hz. An LED is provided on the front panel for visual indication of the presence of both the sub-audio and carrier frequencies.

An operational amplifier buffer stage can be employed when the drive currents of the voltage output exceed 1 mA or when a current loop output is required. The current amplifier is capable of supplying up to 30 mA in either configuration.

Carrier detector alarm and modulation fail alarm circuits are standard on the G-7902C. The presence of both the carrier frequency and the sub-audio frequency can operate two optional relays to indicate transmission status. Upon loss of either or both the carrier and sub-audio frequencies, the relays will de-energize in 0.2 seconds to indicate an alarm. Upon restoration of both frequencies, an adjustable delay from 1 to 10 seconds will occur before the relays re-energize to indicate a return from alarm.

A dc-dc converter can be added to the G-7902C to completely isolate the output stage. This allows the user to drive current loops with a ground without regard to the placement of the tone equipment's ground.

G-7902C FS RECEIVER SECTION

Tones entering the G-7902C FS receiver section first encounter the receiver filter of L1, L2, L3, and L4 and C1, C2, C3, C4, C5, and C6. This filter exhibits a nominal 600 ohm line impedance with rising impedance out of band. For peak and valley adjustments, refer to the receiver filter alignment procedure. FS tones can be observed between TP1 and TP7. U20 amplifies the band-pass filtered FS tones to create a signal that is discriminated and then low-pass filtered by the active filter, U23, to remove the ripple in the input.

U20, U21, U22, U14A, U23, and U3 form the discriminator for the G-7902C. U23 and U24 low-pass filter the tone level and generate an output level for carrier on and off. The carrier presence trip level is adjusted by R115. The sub-audio frequency output of the discriminator can be seen between TP2 and TP7, typically 10 to 30 Hz.

G-7902C TELEMETER CONVERTER SECTION

The sub-audio frequencies detected by the FS receiver and seen at TP2 drive the frequency multiplier, U5. U5 is a mono-stable multi-vibrator with each stage output "OR"ed to produce a frequency-doubled square wave with one half cycle from the sub-audio frequency's leading edge and the other half from the trailing edge. The output of U5 drives the opto-coupler, U15, to allow for an optional isolation of the output stage. If the output stage is isolated from self-ground dc-dc converter, U16 is installed and all grounds in the output will be from U16's output. However, if the output is not isolated, the two grounds will be tied together across the U16 position.

U4, U9, U10, 11a, and b form the frequency-to-voltage converter. U10 serves as a phase comparator and outputs a pulse width on pin 13 based on the phase difference between the frequency generated by U4 and counted down through the circuit of U9 as compared to the X2 modulation input on pin 14. These pulses are low pass filtered by the loop filter to create a proportional voltage (feedback voltage) to drive the voltage-to-frequency converter, U4. Note there is a crystal frequency observed at pin 10 of U4. U4 generates a much higher frequency than the modulation; therefore, U4's output is divided by 8192 or 16384 for a sub-audio frequency range of either 10 to 30 Hz or 5 to 15 Hz, respectively. The feedback voltage from the loop filter to the input of the voltage-to-frequency converter is proportional to the sub-audio (modulation) frequency present at TP2 and is used to generate the dc

output voltage. U11a serves as a filter and 11b serves as an integrator to provide a stable voltage output.

Calibration of the G-7902C output requires the generation of left and right scale sub-audio frequencies at TP2. R76 is provided to allow injection of sub-audio frequencies at terminal 21 when no FS tones are present. At the left scale sub-audio frequency, R55a can be adjusted for the left scale output potential as seen from TP5 to TP6. At the right scale sub-audio frequency, R55b can be adjusted to obtain the span required. Note that for modules with isolated output, TP6 rather than TP7 serves as the common potential. Adjustment of the output calibration of the telemeter converter is a back and forth procedure between right and left scale sub-audio frequencies. The outputs at terminals 11 and 9 provide only 1 mA as limited by the operational amplifier, U13.

Higher current levels can be obtained with the optional current amplifier circuit combining U12, Q3, and Q4. The output current is determined by the current through the parallel network of R50, R51, and R52. The output current is the potential from TP5 to TP6 divided by the parallel resistance of R50, R51, and R52 and is adjustable by R50. The current amplifier provides up to 20 mA into a 500 ohm load, maximum.

G-7902C SPECIFICATIONS

DC Output Span: 100 mV to 10 V, 100 uA to 20 mA ranges standard, custom ranges available from factory.

Modulation Frequency: 10 to 30 Hz standard; 5 to 15 Hz and others available.

Accuracy: 0.15% from -5 degrees C to +55 degrees C.

Linearity: 0.01% of full span.

Response Time: Left scale to right scale in 300 ms.

Output Ripple: Less than 1% for 10 to 30 Hz and less than 4% for 5 to 15 Hz.

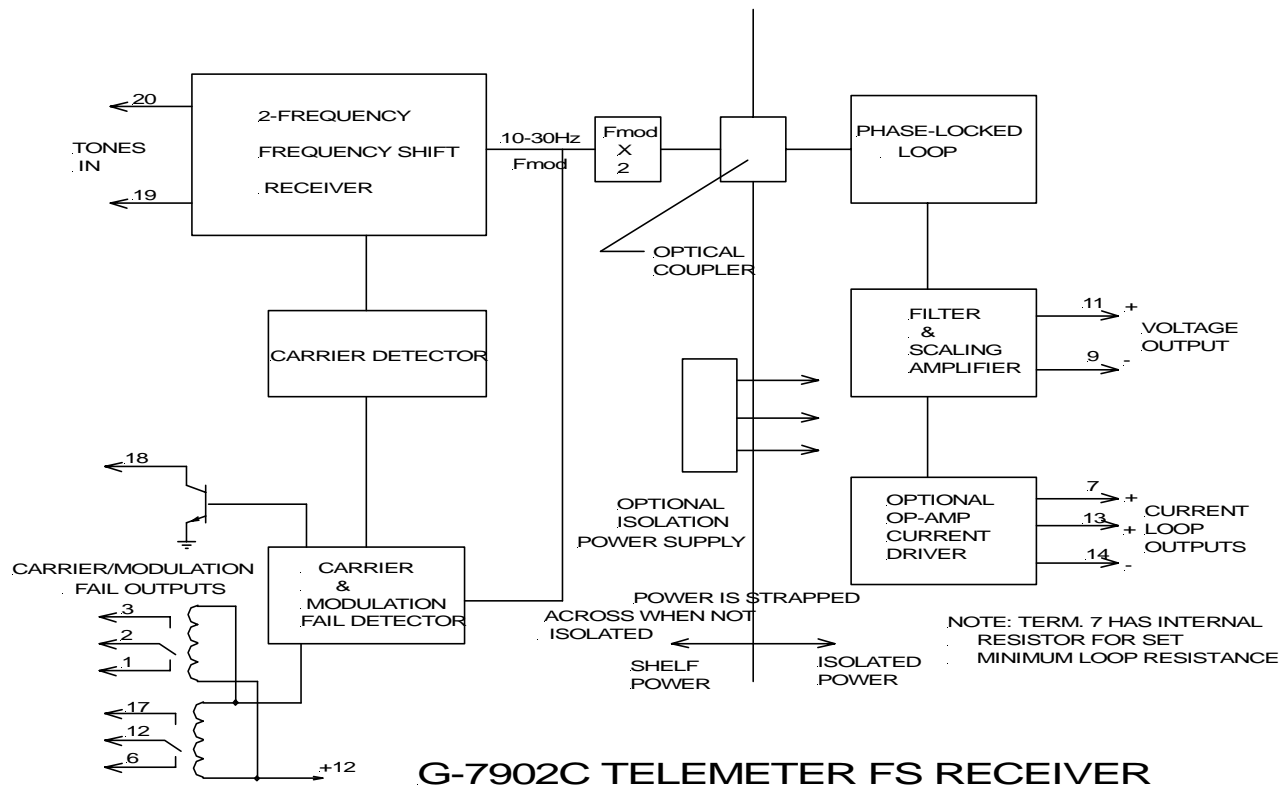
Temperature stability: Better than 0.005% per degree C from -5 to +55 degree C range.

Adjacent Channel Rejection: Better than 32 dB.

FS Sensitivity: -45 dBm with 40 dB dynamic operating range.

Carrier Detector Sensitivity: Adjustable between -10 to -30 dBm.

Power Requirements: +12 V supply, 50 mA; -12 V supply, 25 mA.



G-7902C REPLACEABLE PARTS

C1-7, 15, 16, 17	Capacitor; factory value	R15, 16, 17, 26-29,	Resistor, Precision,
C21, 22, 24, 25, 30,	Capacitor; Tantalum, Sprague,	42, 43, 46-49, 51, 52,	1/8W, 1%
31, 32, 33, 34, 39, 40,	Type 150D	54, 56, 57, 59, 66, 81,	
42, 45, 100, 10-1, 102,		85, 86, 109, 110	
104, 107, 109, 110,		R23, 55A, 55B, 70	Potentiometer, Spectrol,
111			Type 43P
C19,20	Capacitor, Polystyrene, Mallory	R38, 39, 87, 88	Resistor Network, 22K
C23	Capacitor, Polystyrene, .105uf	R40, 50, 58, 103,	Potentiometer, Spectrol,
C27, 27, 28	Capacitor, Mylar, 200V	115, 120	Type 64Y
C29	Capacitor, ceramic, 01uf, 100V	R60, 61	Resistor, Film, 1/2 W, 5%
C41, 44	Capacitor, Ceramic, .05uf, 16V	U23	TL082IP, TI
C43	Capacitor, Mylar, .01uf, 100V	U20, 21, 22, 24	TL081IP, TI
CR10-13, 16, 17, 18,	Diode, 1N4148	U12, 13	TL051CP, TI
20, 21, 23, 24, 25,		U4	AD651AQ, AD
100-108		U5	MC14538BCP, Motorola
CR19	Diode, Zener, 1N823A	U8	MC14069UBCP, Motorola
CR22	LED, Green, 552-0206	U9	MC14020BCP, Motorola
CR26	Diode, Zener, 1N5234B	U10	MC14046BCP, Motorola
CR109	Diode, Zener, 1N5228B	U11	TL052CP, TI
K1, 2	Relay, 160-151Q00	U14	MC14077BCP, Motorola
Q1, 2, 5	Transistor, 2N3903	U15	4N35, Motorola
Q3	Transistor, 2N697	U16	Power Supply, 12B12D, Pico
Q4	Transistor, 2N4037	X1	Crystal, NE33A, 1.048575 kHz,
R25, 34, 37, 41, 44,	Resistor, Film, 1/4W, 5%		
45, 53, 62, 65, 67, 68,			
69, 71-76, 79, 80, 82,			
84, 100, 101, 102,			
104-108, 111-114,			
116-119, 121-124			