TIM

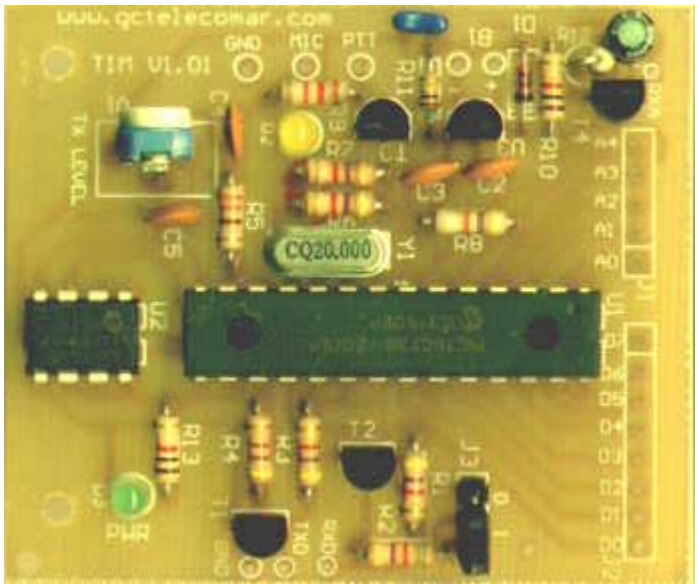
Telemetry Interface Module

User manual V1.0

www.gctelecomar.com

Description.

The TIM board is an APRS compatible, packet radio telemetry unit. When attached to a transmitter, the unit sends GPS position reports, telemetry data, a beacon text message and CW ID at user-selectable time intervals. It is capable of sending these messages via a digipeater path with a maximum of eight hops. The unit accepts GPS data in NMEA 0183 format for position reporting can report five A/D inputs (8-bit resolution) and eight bits of digital input.



Through configuration software, the user is able to customize callsigns and other parameters. An on-board memory stores configuration information indefinitely and configuration software can be run as often as needed to change settings. The on-board voltage regulator accepts power from an unregulated 7-30 VDC source.

Features

The TIM module provides 5 analog-to-digital inputs, labeled A0 through A4. The reference voltages for these inputs are the + 5 VDC supply voltage (+5) and GND, which are digitized to 255 and 0 respectively (i.e., 8-bit resolution). Eight TTL digital input telemetry bits are provided (labeled D0 through D7). When left unconnected, these bits are pulled high and are read as logic 1.

The TIM board interfaces to one's transmitter through the connections labeled MIC GND, PTT, and RXA. Prior to transmitting, RXA is sampled. If logic low (<0.8 VDC) is sensed, transmission will be held off. This is important for collision avoidance on the channel. Once the communications channel is clear, the Push-To-Talk signal PTT is activated (low or high, as selected in software) to key the transmitter, (PTT led will turn on/off as selected in software too), and the information packet is sent out to TXA. The radio's microphone ground should be connected to GND. When transmission is complete, PTT is deactivated. The single-turn potentiometer V1 the signal level on TXA. Clockwise rotation gives maximum amplitude (there is no stop, so if the deadband is encountered, simply turn the potentiometer another 1/2 turn).

Serial communications with the TIM module are required for configuring the device with the user's callsign and other information and also for receiving data from the GPS receiver, if attached. Pads labeled TXD and RXD are the RS232 transmit and receive connections, respectively. Only the RXD connection is used when connecting to a GPS receiver.

Radio and Power Connection Outline

Following is a description of the terminals on the assembled board. The input audio terminal is optional and helps prevent unwanted transmissions over other stations. The other output terminals are of easy connection.

MIC
Audio output from the board to the transmitter. The resistance R9 is connected in the event of using a HT since it lines PTT and MIC are together if you are going to use a transceiver cut R9 and use the MIC and PTT alone

PTT
PTT activation output to transmitter.

B1 + (VCC IN)
Positive power input, from 7 to 30 volts.

B1 - (Ground)
Negative, ground input.

RXA (Audio Input)

This is an optional input from the transmitter audio output to determine if there are other active stations.

J3 I/D

The board has a RS232/TTL converter for the users who use OEM GPS boards. The I/D pines are close T2 transistor and R2 resistor. It comes with it's jumper. If you use a Handheld GPS does not need to touch the jumper in I position. If you uses a OEM GPS board, passes the jumper to D position. In all cases for program the parameters the board from PC the jumper need to be in I position.

System Operation.

Upon power-up, the TIM module verifies that its memory contains a valid configuration. If not, a packet is transmitted stating "CONFIG ERROR" to alert the operator of it's failed status.

Basic wiring for the TIM module when running configuration software is as follows:

7-30 VDC to pad "+" of B1.
Ground to pad – of B1.
Power led, D3, will turn on.

RS232 serial communications to TIM module pads TXD, RXD, and GND. The designation TXD and RXD -- transmit and receive data, respectively -- are relative to the TIM module. Consequently, when connecting the TIM module to a PC for configuration, connect the TIM module's TXD pad to the PC's RXD pin -- DB-9 pin. Similarly, connect the TIM module's RXD pad to the PC's TXD pin -- DB-9 pin. Also connect the TIM module's GND to the ground pin of the serial connection -- DB-9 pin 5.

Basic wiring for telemetry and position use is as follows:

7-30 VDC to pad + of B1.
Ground to pad – of B1.
Power led, D3, will turn on.
If position reports are desired, connect GPS data out and ground wires to TIM module pads RXD and GND respectively.

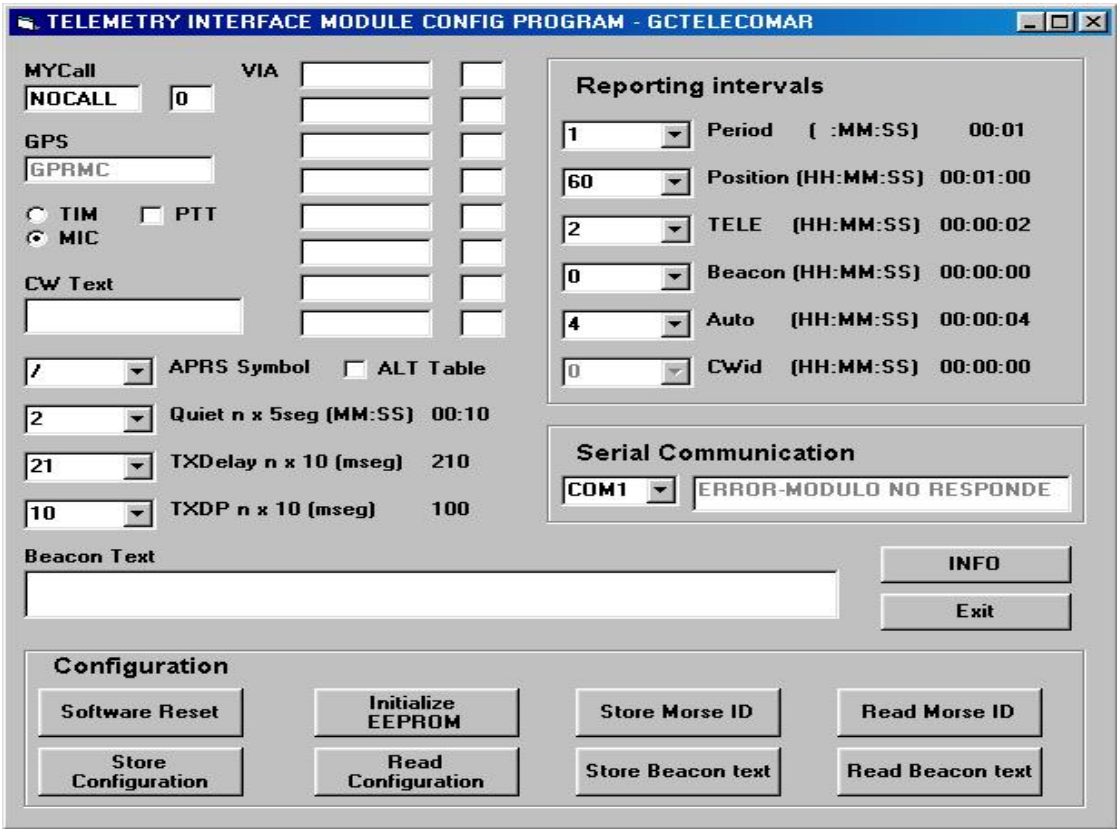
If desired, connect 0-5V analog signals to pads A0 through A4.
If desired, connect 0-5V logic signals to pads D0 through D7.

PTT on radio to TIM module pad PTT (unless HT operation is chosen).
MIC on radio to TIM module pad MIC.
SPK on radio to TIM module pad RXA. SPK is the received audio.

Configuration Software. The program allows the user to customize the TIM device and store the configuration information in an on-board memory. This memory has an erase/write life in excess of 1,000,000 operations. A three-wire communications system is employed -- RS232 send, RS232 receive, and signal ground. From a PC with a DB9 connector, pin #2 is RS232 RXD, pin #3 is TXD, and pin #5 is ground. These should be connected to TIM module pads TXD, RXD, and GND, respectively. (Note: PCs use male connectors for serial ports, so a female connector is necessary when making a cable for configuration.)

Configuration Program

The configuration program run in Windows 9x/Me/2k/XP and allows you to load the parameters to configure the microcontroller. Once the parameters are loaded, the board can be turned off and the data will remain without the necessity of being loaded again, thanks to the EEPROM microcontroller memory.



Callsign
This is the station identification with the ssid from 0 to 15

Path
This optional path will allow to repeated the transmission by digipeaters, eight total.

GPS
GPS string to be use. When operating in TIM mode, any NMEA sentence may be selected and will be sent "as received" from the GPS receiver. For example, to select the GPGLL sentence, write GPGLL. If no argument is given, the default GPRMC is selected. Wildcard characters (?) may also be used to select several messages. For example, write GP???" (Or simply “GP", since the string is padded with "?" characters) will cause the TIM module to send ALL NMEA strings.

TIM
Select TIM mode.

MIC
Select MIC-E mode.

PTT
Active PTT low or high. Low default.

CW text
Store CW text, 12 characters max.

APRS Symbol
This setting sets the symbol with display when the beacon position is received.

Quiet
This setting controls the delay in seconds that must occur after the receiver squelchs, before a transmittion will occur.

Txdelay
This sets the delay in millisecons after the transmitter is keyed until the data begins.

Txdp
This sets the delay time between user's release of PTT switch and the start of transmission.

Period
Base transmission period in seconds, default n=1, (1 second). In TIM mode all time intervals are multiples of this. In MIC-E mode the position field is a multiple of the period. Other times are multiples of position fields.

Tele
Telemetry transmission interval. This number is a multiple of the number of position reports actually sent. A cero value disables telemetry transmissions.

Beacon
Beacon text transmission interval. In TIM mode is a multiple of period. In MIC-E mode is a multiple of the number of position reports actually sent via position.

Auto
Automatic transmission interval, only for MIC-E mode. Auto is a multiple of the position reporting period. When the AUTO timer times out, if the channel has been quiet for a period equal to the QUIET timer, an automatic POSITION report is sent.

CWid
Transmission interval. This value is a multiple period.

Beacon Text
Up to 80 characters in length.

Software Reset
Upon Store Configuration command, the module enters and remains in command mode and will not continue telemetry until reset has occurred. Therefore, once this program is started it is necessary to reset the device even if no attempt was made to change parameters. Reset can also be accomplished by cycling power to the device.

Store Configuration
Sends the current configuration parameters to the module. This configuration remains until changed with another store configuration command.

Initialize EEPROM
Initializes the module to default configuration ,MIC- E, and displays the default parameters.

Read Configuration
Reads and displays current hardware configuration from the module.

Store Morse ID
Writte CW Morse codes in memory.

Read Morse ID
Read CW text in memory

Store Beacon text
Writte beacon text in memory

Read Beacon text
Read beacon text in memory

Serial Communication
Selects COM port for connection to module. If neither 1,2,3 nor 4 are selected, the software will search COM ports for signs of connection to a powered module. The first port, which responds, will be used.

Telemetry and GPS messages

The TIM module provides 5 analog-to-digital inputs, labeled A0 through A4 and Eight TTL digital input telemetry bits, labeled D0 through D7. The telemetry message looks as follows:

T#000,aaa, aaa,aaa,aaa,aaa,dddddddd, TIM v1.1

The three digits following the "T#" are the message sequence number (000-255). This number increment to 255 and then rolls over to 000 and continues. The five groups denoted "aaa" are the five analog data channels displayed in the range 000-255 (ASCII BCD). Channel A0 is the first group and A4 the last. Similarly, the symbol "dddddddd" represents the eight bits of digital data, with D7 sent first.

As an example of the analog data sent back, if A/D channel 1 read 4 VDC (of a maximum 5 VDC), the transmitted value would be (4/5)*255 = 204.

If a GPS unit had not been attached, the GPS messages would not have been sent. Finally, the fact that this is a current GPS is indicated by the words "GPS ON". Had this been an old fix, the text "GPS OFF" would have been sent. Note that the sentence is sent "as received" from the GPS receiver, but without the asterisk (*) and check-sum which normally appear at the end. Instead, the text "/GPS ON" or "/GPS OFF" is appended to indicate the currency of the information.
Depending on the position reporting interval chosen and the NMEA sentence selected, the position report may have various formats:

RAW mode, Position reporting interval = 2 seconds, TIM mode selected, GPRMC or GPGGA sentence.

NORMAL mode ,Position reporting interval >2 seconds OR a message other than GPRMC or GPGGA is selected.

NOCALL/APRS/WIDE2-2>APRTLM>UI,C,f0:
T#000,039,035,033,028,025,11111111, TIM v1.1
NOCALL/APRS/WIDE2-2>APRTLM>UI,C,f0:
T#001,056,050,044,041,036,11111111, TIM v1.1
NOCALL/APRS/WIDE2-2>APRS>UI,C,f0:
$GPGGA,141811,3444.891,S,05822.408,W,1,7,001.1,12,M,015,M,,/GPS ON
NOCALL/APRS/WIDE2-2>APRTLM>UI,C,f0:
T#002,050,045,038,034,030,11111111, TIM v1.1
NOCALL/APRS/WIDE2-2>APRTLM>UI,C,f0:
T#003,057,048,045,042,035,11111111, TIM v1.1

Part List

It is detailed the list of components of the board. Each component is suitable one in the printed board and in the chart with their number of part.The resistance R9 is connected in the event of using a HT since it lines PTT and MIC are together.

Part	Description
U1	16F73 pic
U2	93LC66 memory
U3	78L05 +5 voltage regulator
T1,T2,T3,T4	BC548 NPN transistor
R1,R2,R3,R4,R6,R7	4K7 resistor (yellow-violet-red)
R5	330 resistor (orange-orange-brown)
R8	47K resistor (yellow-violet-orange)
R9	2K2 resistor (red-red-red)
R10	1K resistor (brown-black-red)
R11	100 K resistor (brown-black-yellow)
R12	100 resistor (brown-black-brown)
C1	10uf x16 V capacitor
C2,C3,C4,C5	.1uf capacitor (104)
D1	1N4148 diode
D2	Red led 3mm
D3	Yellow led 3mm
V1	1 K trimmer
Y1	20 MHz Crystal
J1,J2	not include
J3	three pin connector