MGL Avionics

RDAC XF

RS232 Protocol

General

The RDAC XF provides a standard RS232 port with RX and TX data lines.

Format is asynchronous, 8 bits, 1 stop bit, no parity at 38400 baud.

Data

During normal operation a single data packet is sent at intervals containing all of the measured data.

The RDAC is implemented as a generic device. This means it does not know the type of probes connected to its various inputs. Effectively it can be seen as a generic analog to digital converter. It is up to the connected equipment to interpret the measured values.

Data packet

The data packet is sent 10 times per second, approximately every 100mS.

```
 TRS232TXData = record
            DLE,STX,ID,VER: byte;
            Flow1,PulseRatio1,Flow2,PulseRatio2: word;
            TC1,TC2,TC3,TC4: smallint;
            TC5,TC6,TC7,TC8: smallint;
            TC9,TC10,TC11,TC12: smallint;
            OILT,OILP,AUX1,AUX2: word;
            FUELP,COOLANT,FUELLEVEL1,FUELLEVEL2: word;
            RPM1,RPM2,MAP,CURRENT: word;
            Temperature: smallint;
            Volts: word;
            CheckLow,CheckHigh: byte;
         end;
```

DLE: Fixed value $05

STX: Fixed value $02

ID: Fixed value $01 (message type)

VER: Fixed value $01 (version of data, currently version 1)

Flow1,Flow2: Fuel flow expressed in number of pulses per 4 second period. PulseRatio1,PulseRatio2: Mark/Space ratio on fuel flow inputs. Used to connect to fuel injectors. Range 0-1000. 500 = 50/50 ratio. $FFFF = no pulses.

TC1-TC12: Differential inputs amplified and null drift compensated. Gain suitable for K-type thermocouples (very linear) in degrees C. Note: relative to cold junction temperature of zero degrees. For final value, add temperature in this message.

OILT,OILP,AUX1,AUX2,FUELP,COOLANT,FUELLEVEL1,FUELLEVEL2: 12 bit ADC value

relative to 5V. Value of 4095 is 5V. Note: Due to internal system operating at 3.3V the value of 4095 is not reached due to scaling. The ADC saturates at values close to 3900.

RPM1,RPM2: RPM assuming 1 pulse per rotation (scaling to be done in EFIS). Note: In order to allow high RPM measurements used for some turbines, RPM above 50.000 is scaled as follows:

$(((RPM>=50.000) – 50.000) / 10) + 50.000$

Example: RPM is 75.000, transmitted value is 52500. On receiving end subtract 50.000 if value is greater or equal to 50.000, multiply remainder with 10 and add back 50.000 to regain original value.

CURRENT: 12 bit ADC value relative to 5V. 2.5V is nominal zero current with most sensors = ADC value 2048. Value increases or decreases with current flow and current direction.

MAP: Value of internal output from Freescale MPX4250 pressure sensor connected to 12 bit ADC. Consult Freescale datasheets for transfer characteristics.

TEMPERATURE: Temperature in degrees C.

VOLTS: Operating voltage for RDAC. To obtain value in volts use the following function:

function ToVolts(v: word): string;

begin

  result:=IntToStr(round(v/5.73758));

  if length(result)=1 then result:='0'+result;

  Insert('.',result,length(result));

end;

This function returns voltage with a resolution of 0.1 volts.

CheckLow: Data integrity checksum. Modulus 256 addition of all bytes between and including ID and the last byte before CheckLow. The value $55 is then added to this, also modulus 256.

CheckHigh: Data integrity checksum. Modulus 256 addition of all bytes between and including ID and the last byte before CheckLow. The value $AA is then added to this, also modulus 256.

Calibration packet

Calibration data can be requested.

  TRS232TXCalib = packed record

       ID,VER: byte;

       V_AmbientCalib: smallint;

       V_TCCalib: smallint;

       V_AnalogCalib: word;

       CheckLow,CheckHigh: byte;

      end;

The ID for this packet is 2

V_AmbientCalib: Current calibration value for the ambient temperature sensor

V_TCCalib: Current calibration (gain) value for the thermocouple amplifier

V_AnalogCalib: Current calibration value for the ADC

Checksums are calculated as with packet ID 1.

Get calibration

Message to send to RDAC to request calibration message

$05 $02 $81 CHKL CHKH

Checksums are calculated as with messages sent by RDAC

Program calibration

Message to send to RDAC to program calibration data into Flash memory (needs to be done after calibration complete).

$05 $02 $A0 CHKL CHKH

Checksums are calculated as with messages sent by RDAC

Temperature calibration

Message to send to RDAC to change calibration of temperature sender

$05 $02 $82 VALLOW VALHIGH CHKL CHKH

Checksums are calculated as with messages sent by RDAC

Value to send is required calibration value as signed 16 bit offset in degrees C

TC amplifier gain calibration

Message to send to RDAC to change calibration of thermocouple amplifier gain

$05 $02 $83 VALLOW VALHIGH CHKL CHKH

Checksums are calculated as with messages sent by RDAC

Value to send is required calibration value as signed 16 bit offset in degrees C

Analog calibration

Message to send to RDAC to change calibration of ADC converter

$05 $02 $84 VALLOW VALHIGH CHKL CHKH

Checksums are calculated as with messages sent by RDAC

Value to send is required calibration value as signed 16 bit offset (ADC value)

MAP sensor calibration

Message to send to RDAC to change calibration of MAP sensor.

$05 $02 $85 VALLOW VALHIGH CHKL CHKH

Checksums are calculated as with messages sent by RDAC

Value to send is required calibration value as signed 16 bit offset (ADC value)

Voltage measurement calibration

Message to send to RDAC to change calibration of voltage measurement

$05 $02 $86 VALLOW VALHIGH CHKL CHKH

Checksums are calculated as with messages sent by RDAC

Value to send is required calibration value as signed 16 bit offset

Little endian format

All multibyte data values are in little endian format (also known as "Intel" format). The least significant byte is transmitted first.

Data type "word" is unsigned 16 bit integer. Data type "smallint" is signed 16 bit integer.