Description of State of Health Channels for Q330 Systems

The SEED channel definition shown is that recommended and included in factory default settings. The SEED channel is a user configuration so the three character definition may differ from those listed here.

Construction of the channels by the Data Processor software should follow recommendations in the DP writers guide, and the channel identifications are described in the Q330 communications protocol document.

Message type:

LOG a text log of 330 and operator actions produced by the Data Processor. The text is packetized into MSEED format for efficient telemetry and storage using date stamps local to the DP system. This may also include average_report filter running on certain channels. These are text output from data calculations, typically max, min and rms value over an interval. Data rate is event driven, there are no units. See DP writers guide.

Timing Type:

ACE a text log of significant changes in clock status. Daily status and any time discontinuities as reported by Q330. Data rate is event driven, there are no units. See DP writers guide.

Opaque Type:

OCF is binary configuration structures encapsulated in MSEED opaque data blockette form. The configuration structures are produced at the start and stop of recording and at intervals, such as daily. There are no units.

Data Type:

VMU VMV VMW etc: Boom Position Channels 1-6, commonly referred to as mass position channels because they usually record the mass position outputs of broadband seismometers. The rate is fixed at 0.1 sps, so the SEED channel code should begin with VM?. The channel identifier depends on the type of sensor. Typically VMU VMV VMW is for STS2 sensors and VMZ VMN VME for Guralp or STS1 sensors. The unit is 128 counts = 12.5 Volts or 10 counts / volt. Source is a DT_DATA packet with channel id 10100000 where the three signed 8 bit parameters are respectively boom position channels 123. For Boom position channels 456 the source is a DT_DATA packet with channel id 10100001 where the three signed 8 bit parameters are respectively boom position channels 456

LCQ Clock channel, clock quality as a percentage. Calculation of the percentage uses three pieces of information:

1. The clock DP token, consisting of the fields:
   - zone : 32 bit signed offset in seconds
   - degrade_time : 16 bit loss of lock in minutes before degrading 1%
   - q_locked : 8 bit PLL Locked quality
   - q_track : 8 bit PLL Tracking quality
   - q_hold : 8 bit PLL Holding quality
   - q_off : 8 bit Currently Locked, PLL Off
   - q_spare : 8 bit Spare
   - q_high : 8 bit has been locked highest quality
   - q_low : 8 bit has been locked lowest quality
   - q_never : 8 bit Never been locked quality
   - clock_filt : 16 bit minimum seconds between clock messages
2. The raw bitmap of clock status, either from a status poll or from a DT_DATA packet with channel id 10011000 the 8 bit parameter, let's call this "qual".
3. The minutes since the clock has been locked, either from a status poll or from a DT_DATA packet with channel id 10011000 the 16 bit parameter, let's call this "loss".

The calculation (of "val", the percentage) is as follows:

```
if (qual >= PLL_TRACK) or (qual and (CQ_3D or CQ_2D or CQ_1D) <> 0)
  then
    case qual and PLL_LOCK of
      PLL_LOCK : val := q_locked ;
      PLL_TRACK : val := q_track ;
      PLL_HOLD : val := q_hold ;
      PLL_OFF : val := q_off ;
    end
else if qual and CQ_LOCK <> 0
  then
    begin
      if degrade_time <> 0
        then
          i := q_high - loss div swap(degrade_time)
        else
          i := q_high ;
      if i < q_low
        then
          i := q_low ;
      val := i
    end
  else
    val := q_never ;
```

LCL* Clock channel, lock loss in minutes. A counter indicating the time since the last clock lock. The data rate is 1 sps and units are minutes. Source is a DT_DATA packet with channel id 10011000 second parameter (16bit).

LCE clock channel, phase error in microseconds. The difference between UTC and the sample clock. The phase error has already been applied to the time labels. Note that in the case of an unlocked clock, the phase error reported is held at the last value known. The data rate is 1 sps and units are microseconds, positive means the sample clock lags UTC. . Source is a DT_DATA packet with channel id 10011000 third parameter (32bit).

VEH* Analog status channel, internal analog supply rail, positive side. The sample rate is 0.1 sps and units are 10mV. Source is a DT_DATA packet with channel id 10101001 second parameter (16 bit)
VEL* Analog status channel, internal analog supply rail, negative side. The sample rate is 0.1 sps and units are 10mV. Source is a DT_DATA packet with channel id 10101010 second parameter (16 bit)
UKA* Analog status channel, Seismometer temperature on sensor A connector as reported by digital ID device. The sample rate is 0.01 sps and units are degrees C. Source is a DT_DATA packet with channel id 10100010 first 8bit parameter.
UKB* Analog status channel, Seismometer temperature on sensor B connector as reported by digital ID device. The sample rate is 0.01 sps and units are degrees C. Source is a DT_DATA packet with channel id 10100010 second 8bit parameter

VPB Logical Port status channel, the percentage of telemetry packet queue in use for the current Data Port. The data rate is 0.1 sps and units are 0.1%. Source is a DT_DATA packet with channel id 10001001 16 bit.

VCO PLL channel, VCO value. A measure of the automatic adjustment applied to the oscillator to raise or lower the clock frequency to phase lock with UTC. The median value is 2048 and ranges between 0-4095. The data rate is 0.1 sps and units are unspecified. Source is a DT_DATA packet with channel id 10001000.

VKI System status channel, 330 internal temperature in degrees C. The data rate is 0.1 sps and units are degrees C. Source is a DT_DATA packet with channel id 10000000 second 8bit parameter.
VEA System status channel, the current supplied to the GPS antenna in milliamps. The data rate is 0.1 sps and units are mA. . Source is a status request packet. Source is a DT_DATA packet with channel id 10000001 second 8bit parameter.
VEC System status channel, 330 system input power supply current in milliamps (not including current passed through to Baler, sensors, etc that may share a power connection via a 330 connector). The data rate is 0.1 sps and units are mA. Source is a DT_DATA packet with channel id 10000001 first 8bit parameter.
VEP System status channel, 330 system input power supply voltage. The data rate is 0.1 sps and units are 150mVolts per count. Source is a DT_DATA packet with channel id 10000000 first 8bit parameter.

* indicates a channel not normally included in the factory default status channel configuration.