Dicam Data Logging Capabilities

Dicam Control/Slave master unit networks consist of up to 30 Dicam units, connected with a Dicam peer to peer network. One of the units is a "Logger" with a modem.

Data is logged in one of the following categories :

Sensors (readings from Dicam sensor inputs)
Outputs (recording controlled output levels on Dicam units)
ASMs (application specific messages)

Sensors

Sensor Inputs can be logged in two ways :
- Analogue
- Digital

Analogue
Sensor inputs are 0 to 5V dc, 10 bit resolution (5mV approx). In most cases sensors are powered from the reference 5Vdc output on the unit.
Resolution 0.1ºC (ºF approx) with standard Dicam TS4 sensors.
Other sensor types with 0-5v DC outputs can also be measured such as 0 - 1V or 0 to 5V dc humidity sensors.
Non Dicam sensors can be measured as raw values, using standard software conversions, or "non-converted" (raw ADC values 0 - 1023).

Digital
The same sensor inputs are used, but in a digital (high-low) manner. These can be configured in two way :
- Timed
- Pulse

Timed inputs count up when the input is "on" and used for such as feed augers. A mains detector is connected to the feed auger, such that it switches on when the auger is running (i.e. powered). The input counts up when the input is "on" with a resolution of either $1/10^{th}$ or $1/20^{th}$ of a second.
Pulse inputs count transitions - such as contact closure in a water meter. For example, each time a water meter delivers a unit quantity of water, it makes a contact, which is detected and counted. Units can count pulse transitions at up to 300 Hz.
In either case, counting can be of either polarity.
Inputs accept 0 - 5Vdc signals, but we recommend galvanic isolation where practical, for maximum protection - for example by using signal relays or opto-isolation (open collector) devices such as MD2 isolation modules (available in a range of operating voltages).
Digital inputs use 16 bit roll over counters - max 32,768 - so data rate must be within the maximum count during each logging interval.
Usually, either pulse or timed readings are needed, but if necessary, a device can be connected to two inputs to record both. (For example, to record how many times a motor starts and how long it runs in total.)

Outputs

Dicam control outputs operate - in software terms - using a "Level" instruction from 0% (off) to 100% (on). Output channel software (in Dicam control programs) converts the level instruction to a corresponding output switching pattern, and the hardware output sends this to the switching circuit (driver) which carries out the switching function.

For example, if the output channel type is set for a speed control fan, the output software times the signals exactly to match the mains phase. When applied to the driver module (connected between the mains and the fan), the fan speed varies.
Outputs can be logged, either as on-off only, or as a variable level.
It should be noted that outputs are "open loop". That is the outputs send the appropriate control signals to the driver module, but there is no feedback on the action of the equipment controlled.
So, for example, logging might indicate that a particular fan output is at 50%, but it cannot determine whether or not the fan motor itself is running at 50% speed.

ASMs

Application Specific Messages include a wide range of information to do with the operation of the control program itself. For example, the current Set Temperature, or alarm status.
The range of ASMs depends on the type of program (hence the term "application specific"). For example, here is part of the available list for a common controller type :

0 Mean temp in 0.01C
1 Set temp in 0.1C
2 Rate limited set temp in 0.1C
3 Min vent level %
4 Freshen level %
5 Room curve day number (0 for off)

This list varies considerably from controller type to controller type, but is generally similar with a particular type, and generally includes things that are liable to change. (For example, there would be no point in logging configuration values which, once set, would not normally be changed.)
Many ASMS are "room specific". That is, if a controller regulates several air spaces, there will be values for each room. For example, there would be Room 1 Set temp, Room 2 Set temp, and so on.
In some cases, ASMs may include user set parameters which are not used by any of the control routines, but merely as a way of obtaining the data. An example being "Pig Numbers". The user sets the value, but it is only used for logging, it does not affect the controller operation.
The ASM method can also be used to provide "application support" for certain types of sensor where the reading may need local processing - such as wind direction.

Logging Capacity

Logging capacity limitations are determined in two ways :
- Number of factors being logged
- Duration

The logger does not log all possible available data on the network. Since there could be up to 30 units in total, each with 8 inputs, 8 outputs, one or more rooms and associated ASMs, an automatic provision for all that might be connected would inefficient.
Instead a logger has a configuration defined in terms of input address, output addresses and ASM numbers. For example, taking the ASM list given above, ASM 17/3/5 would be Room Curve Day Number in Room 3 at network Unit Address 17.

This configuration is defined in the "permanent" memory of the logger unit. Technical factors mean that the number of parameters which can be logged is not fixed, but is typically around 300 in total maximum.

Logging configuration is normally carried out via modem by our engineering staff. Once logging is configured, the logger reads the desired parameters over the network, and stores the current (most recent) values of all parameters at the chosen interval into RAM memory. (Battery backup is essential to prevent loss of data during mains failure.) In most cases,

storage is every 15 minutes, which gives a reasonable balance between detail and total logging time.

When storing in temporary memory, data is compressed using a high efficiency algorithm. Due to varying degrees of compression achieved, and varying number of parameters, total logging period is not fixed and typically varies from 3 days to 60 days. Logging time is not normally a limiting factor, since data is usually downloaded long before memory is full.

In most cases, logged data is downloaded and processed under a "Barn Report" service contract. As well as providing the configuration and download service, this includes use of the Barn Report presentation program and Internet access. Clients can, instead, have a connection and download program (Lanif98), which has a data conversion utility for raw data, though features are more limited.

Notes

1 Inputs can be logged irrespective of whether they have a control function. For example, mains detectors (MD2) modules can be connected to any spare (unused) input to measure and count the presence/absence of mains, even though this data is not used for control or alarm purposes.

2 Outputs, similarly, can be logged but readings only have any purpose if being used.

3 The logger samples data and is not event driven. For example, an output may be logged as being at 0% at two successive logging intervals, but could have been an any level interval in between. (This is particularly relevant when logging cycling outputs such as foggers or timers.) "Event" type data is only logged if it remains in a particular state beyond at least logging - for example, alarm conditions might not be logged if they occur and are cleared in less than 15 minutes.

4 Logging is configured by our engineering staff using their own experience, bearing in mind client preferences. Logging space is limited, and more logged parameters mean shorter logging duration. Shorter logging duration means greater risk of data loss in the event of communication problems. Logging may be a compromise on larger networks, although there are technical solutions (see below).

5 Data is logged in "raw" form. For example, analogue sensor readings are stored as ADC values, and digital inputs as counter values. Processing is required to convert the data into usable form. For example, water meter readings much be differentiated and then integrated to produce daily values (if required). Standard software can handle most types of inputs, but bespoke processing may be needed for some types of measurements.

6 Some types of inputs require "in unit" processing, such as Air Quality sensors. These units have a non linear output, and require continuous compensation of sensor reading against temperature. The logged reading is an ASM, not a sensor reading.

7 Barn Report has facilities for import and use of additional data sources - for example customer-generated csv files containing number of animals.

8 If a site's logging requirements exceed the capacity of an individual logger, there are two possibilities - a second logger on the same network, or two networks on the site, each with a logger. In either case, a second telephone line (or compatible line switcher) and modem is needed.

9 Whatever the logging interval, it is the same for all parameters. E.g. it is not possible to log one sensor at 15 minute intervals, and others at 1 minute intervals. Should such features be needed, they would require special application support.

Standard Analogue Sensor Conversions	
TS4-C	Dicam TS4 temperature ºC
TS4-F	Dicam TS4 temperature ºF
RHS1V	Relative humidity 0-1V 0-100%
RHS5V	Relative humidity 0-5V 0-100%
TS1V	Temperature 0-1V 0-60ºC
TS1V2	Temperature 0-1V -40-60ºC
SPUD	Special surface resistance sensor

LIGHT	ORP 12 relative 0 - 100
TS1KF	Special temp sensor
AKS33L/H	Special pressure sensor
POT	Potentiometer 0 -5V

For non standard sensor types, any 0-5Vdc sensor or detector can be measured and logged (and other voltages or e.g. 4-20ma by input attenuation), and usable readings can be obtained by one or more of the following :

- bespoke extensions to sensor types
- use of standard sensor conversion with post processing in Barn Report
- user manual post processing using spreadsheets
- special application program support

For example, the QBM65-1 pressure sensor (0-100Pa, 0-10Vdc output) can be measured by first attenuating the 0-10V signal (2:1 reduction), using the RHS5V input type, and post conversion (0-100% = 0-100Pa).

Special application support means that the program in the on site Dicam units is specially modified for a special sensor, and the reading may then be logged as either a "standard" sensor type or an ASM. (For example, wind speed measurement requires special sampling and averaging, and therefore needs a special application program.)

User manual post processing using spreadsheet means measurement and logging without processing. The system logs the value as a 10 bit analogue value (producing values 0 - 1023) for an input range of 0 - 5Vdc. These values can be exported for use in a spreadsheet, where the user's own spreadsheet functions are applied - for example, using a look up table.

Maximum Capabilities	
Sensors	240
Outputs	240
ASMs	200
Max total parameters	300 (typ)
Logging Interval	1 sec - 18 hrs 1 - 30 minutes (typ)

Note : The foregoing applies to Dicam Control/Slave master unit based networks. Capabilities of Dicam Slan based networks differ.