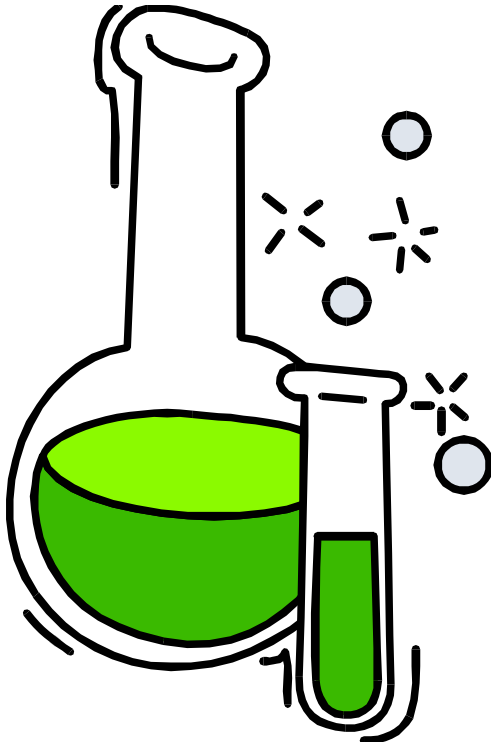
CAN Based Monitoring System



Adam Davis

06/02/04

CAN Based Monitoring System

- **CAN-Based Monitoring System for L1T**
  - L1T CAN overview
  - Purpose of monitoring system
  - Minimal Requirements CPM & CMM
  - Minimal Requirements TCM
  - Define message frames
    - Standard CAN Data Frame
    - Module Addressing Scheme
    - DATA frames
    - Alert Message Frames
    - System Capabilities

Adam Davis

L1T CAN Overview

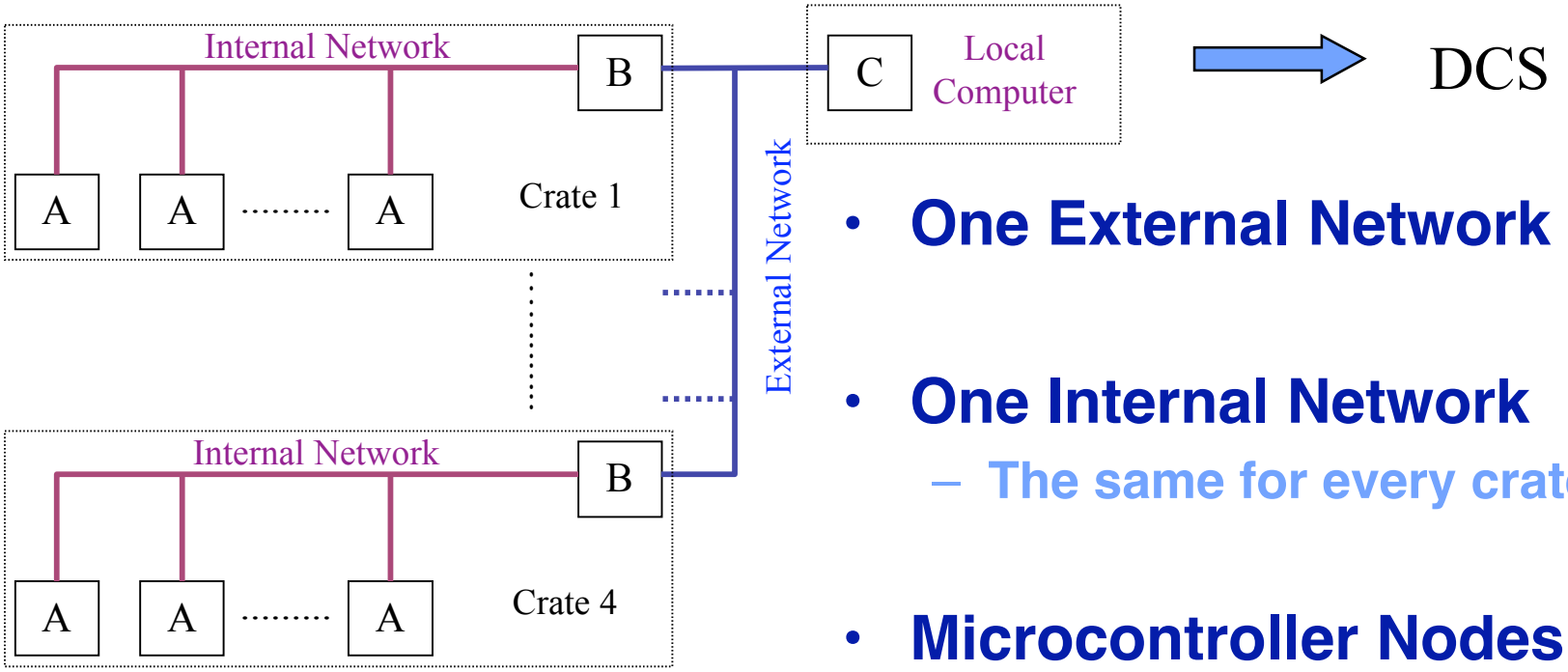


Figure 1.1 L1T Controlled Area Networks

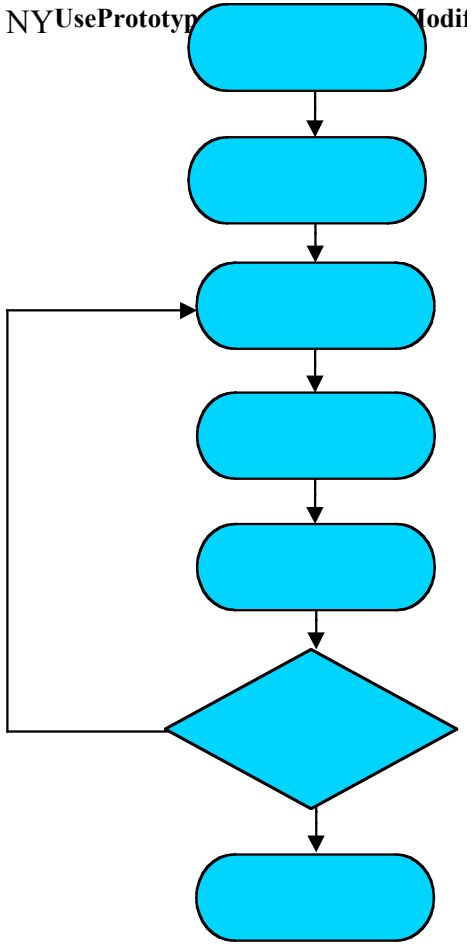
- **One External Network**
- **One Internal Network**
  - The same for every crate
- **Microcontroller Nodes**
  - Software “A” the same
  - Software “B” the same

Purpose of Monitoring System

- To Monitor card voltages and if fluctuations extend beyond pre-determined thresholds alert DCS.
- To Monitor card FPGA temperatures and if temperature gets too hot and extend beyond thresholds, alert DCS.
- To Monitor card GLINK temperatures and if this extends beyond a pre-determined threshold, alert the DCS.
- Control.?

System Development
Evolutionary Prototyping

- **Prototyping**
  - No real specification
  - Close liaison with customer
  - History of development & documentation
  - Working system based on minimum requirements then develop further.



Minimum Requirements
CMM & CPM

- **Common Merger & Cluster Processor Modules**
  - Monitor FPGA temperatures
  - Monitor Local Voltages
  - Monitor GLINK Temperatures
  - Send Info Packets to TCM when requested
  - Alert TCM of problems
  - Respond to scan request issued by TCM ...

Minimum Requirements
TCM

- **Timing Control Module**
  - Alert the local PC of problems ...
  - Read / Write to local RAM)
  - Request information from Modules)
  - Store module information in memory)
  - Scan the crate ...

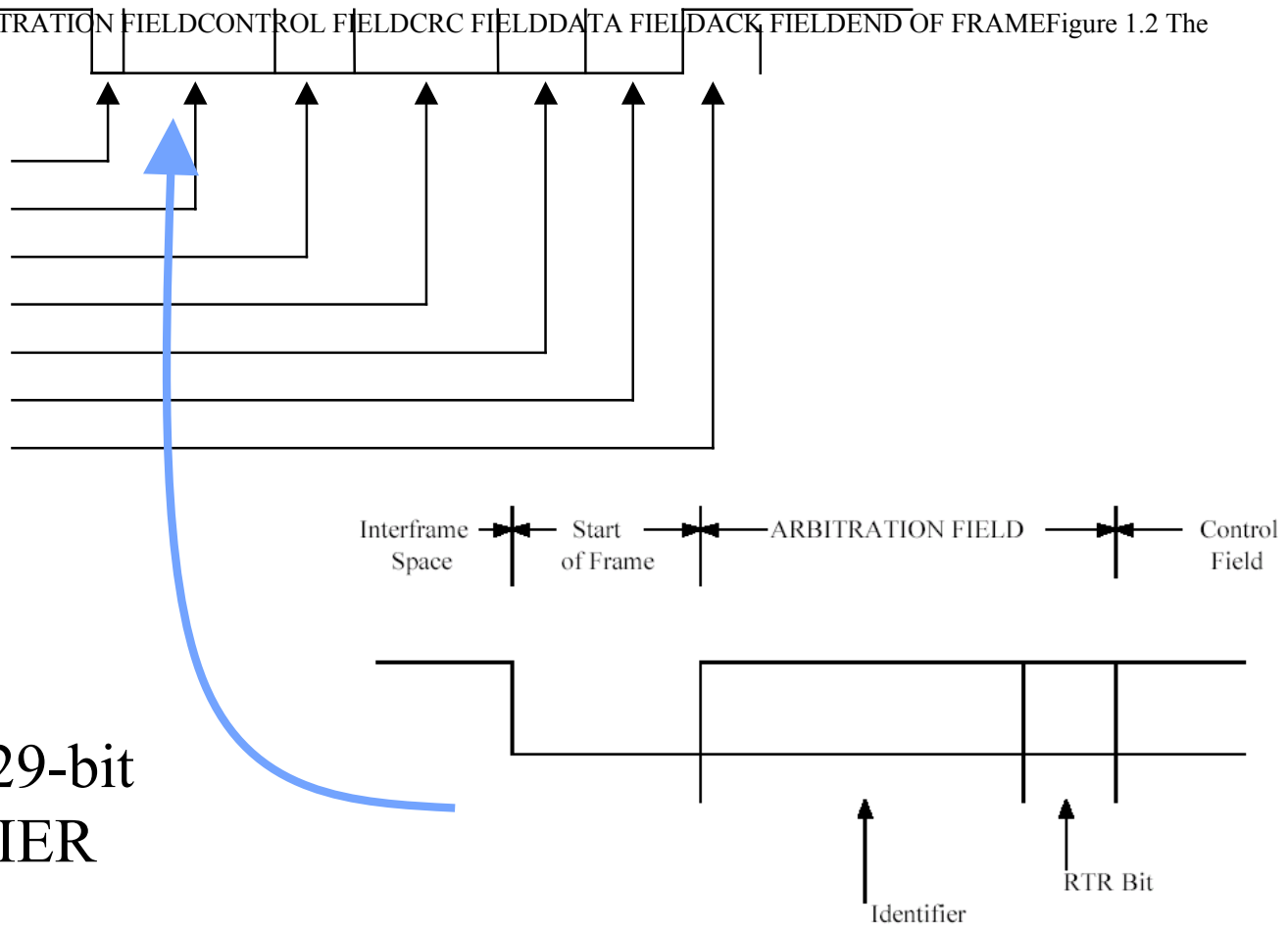
Define Message Frames

CPM & CMM to TCM

- **Message Types**
  - Standard CAN Data Frame
  - Data Frames
  - Alert Message CPM & CMM to TCM
  - Alert Message TCM to PC
  - Scan Frame

Standard CAN Data Frames

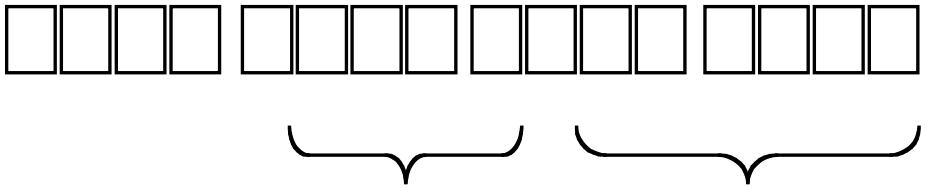
START OF FRAMEARBITRATION FIELDCONTROL FIELDCRC FIELDDATA FIELDACK FIELDEND OF FRAMEFigure 1.2 The



11-bit or 29-bit IDENTIFIER

Addressing Scheme

0000000001000000 LSB MSB Module Address Crate Address 11



Module Address	CMM Slot 31

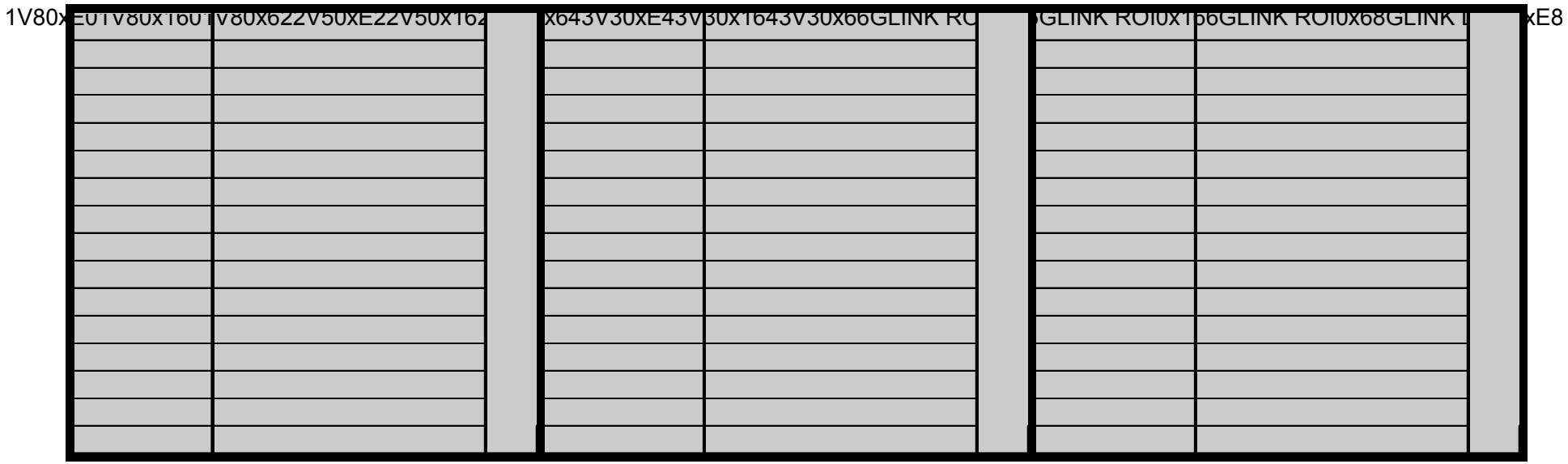
- **Messages from CPM & CMM to TCM**
  - Module Address Only
- **Messages from PC to specific card**
  - Module Address & Crate Address
- **Obtain Address from Backplane**
  - Lookup table GA - Address

Timing Control Module Code

```
char X = 0x01;
while(1){
    if(X = 0x24){
        X = 0x01;
    }else{
        if(X = 0x01){
            X=X+1;
        }else{
            X=X+2;
        }
    }
    RemoteFrame(X);
}
```

ModuleAddress	CMM Slot 31

Memory Map


1V80xE01V80x160
V80x622V50xE22V50x162
x643V30xE43V30x1643V30x66GLINK RO
GLINK ROI0x166GLINK ROI0x68GLINK
xE8

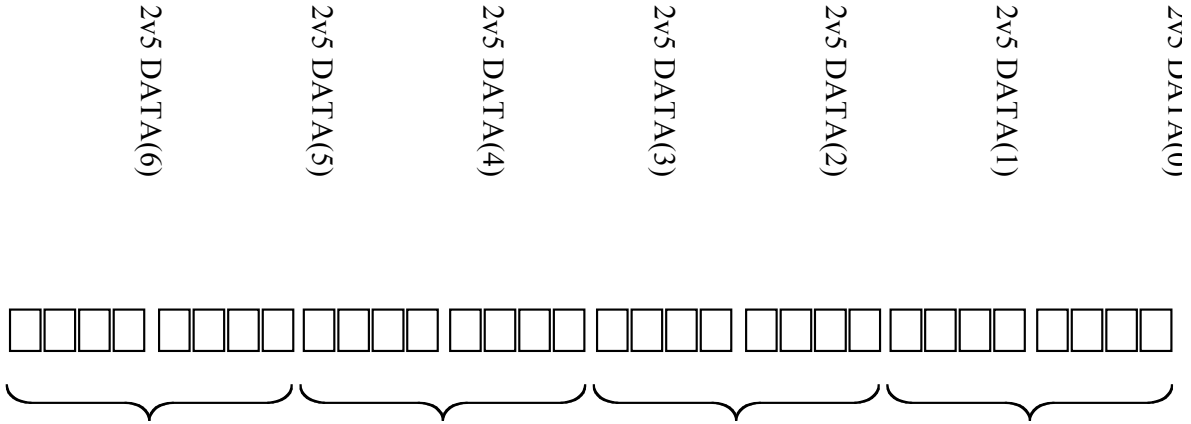
Data Frames

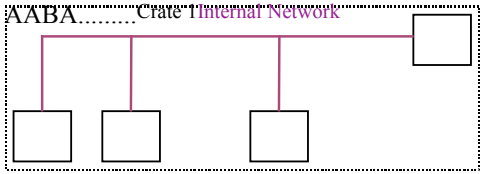
CPM & CMM to TCM

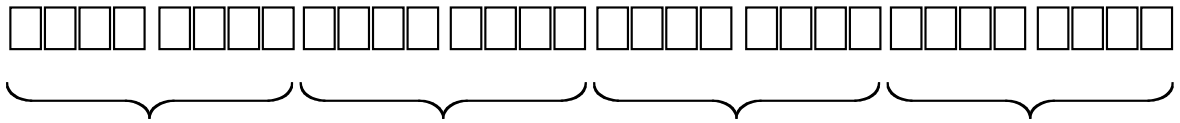
Message Buffer 15

CMM & CPM

(8-bytes)







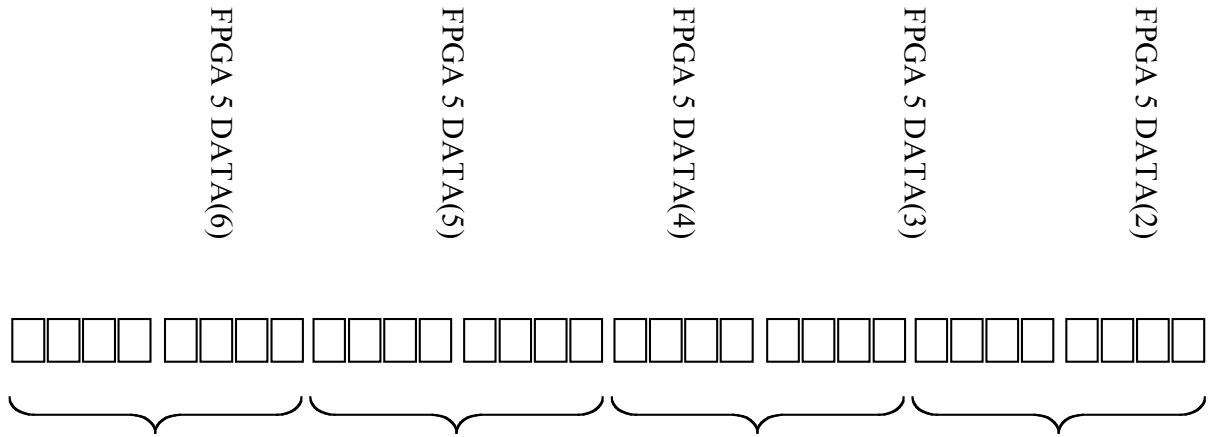
Data Frames

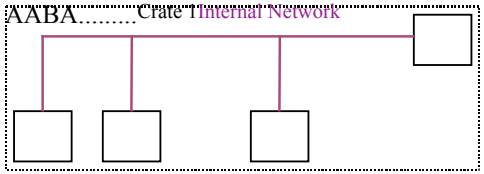
CPM to TCM

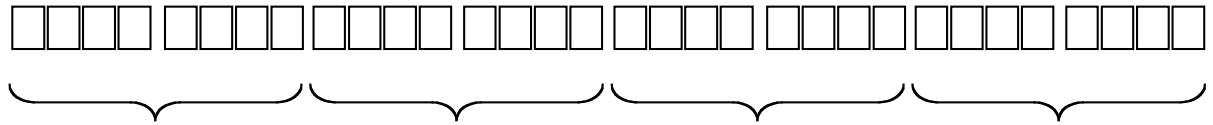
Message Buffer 14

CPM ONLY

(8-bytes)



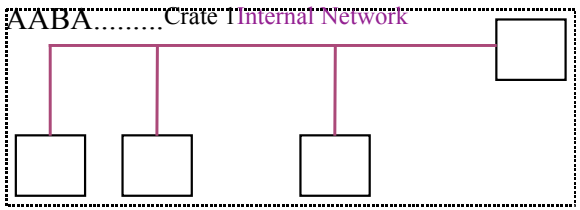


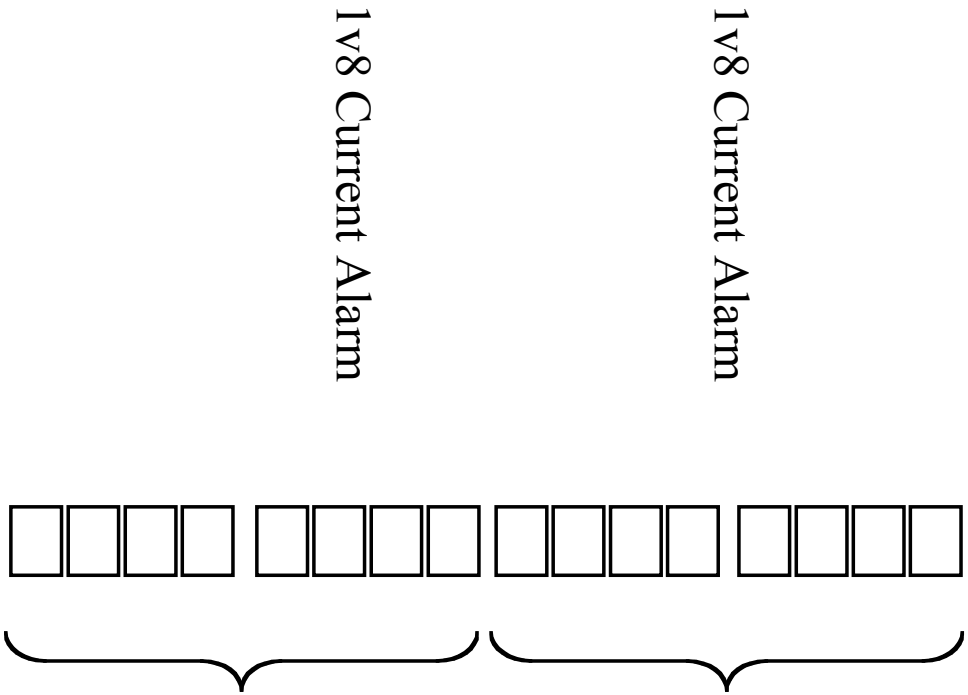


Alert Message Frame

CPM & CMM to TCM

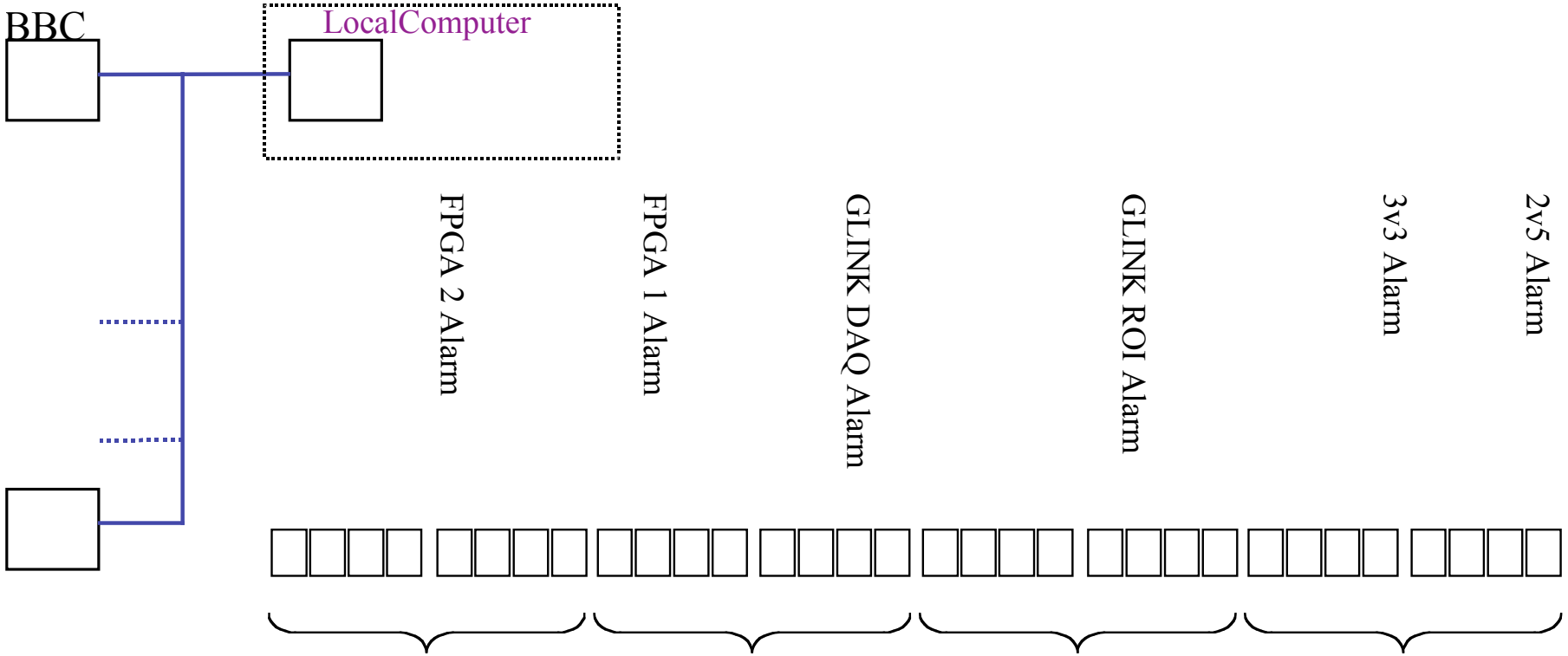
- **Card identification embedded in data frame**





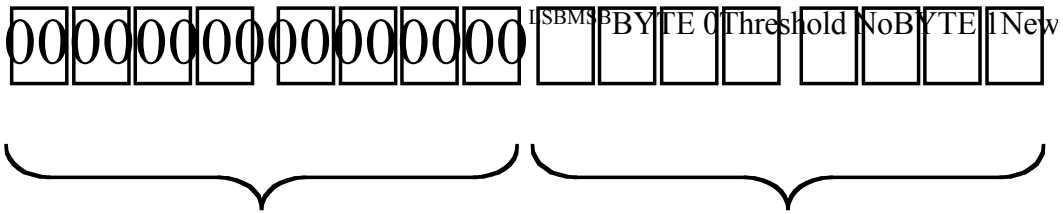
Alert Message Frame
TCM to PC

- **Crate identification embedded in data frame**



System Capabilities
Adjust Comparison Threshold Values

- **Minimum Requirements have no control.!**
  - Every module in the system is individually addressable, there is the possibility that the local computer could be used adjust the threshold values used for alarms and various alarm levels could then be set.



ThresholdNo	All	1V8	12V5	3V3	GLIN

System Capabilities
PC to Timing Control Modules

- **Minimum Requirements has no communication to TCM.!**
  - The PC currently relays information from the TCM's in the system to the Detector Control System, when an alarm occurs.
  - The PC could regularly REQUEST information from each of the Timing Control Modules to obtain a "download" of its memory.
  - Plot Temperature trends and forecast fan failure, filter failure, power supply failure and component failure.
  - Gather component failure statistics for certain periods of time.

System Capabilities

Current Buffer usage

Buffer No	Data Size	Function	158 - Bytes	Read-out buffer (CPM & CMM)	148 - Bytes	Read-ou

UNUSED

Summary

- **Specification Document produced**
- **If Agreed :-**
  - **Start Software development for PC - Andrey Belkin**
  - **Finalise Software for Microcontrollers**
  - **Testing**