CAN Precharge Controller Communications Protocol Specification

24 February 2009

Brisbane, Australia
http://www.tritium.com.au

TABLE OF CONTENTS

1 INTRODUCTION

This document describes the protocol used to communicate over a CAN bus connection to and from the Tritium precharge controller device.

2 CAN CONFIGURATION

2.1 HARDWARE

The CAN hardware interface used is compatible with the CAN 2.0B standard. The supported bit rates (bits per second) are 1 Mbps (default), 500 kbps, 250 kbps, 125 kbps, 100 kbps and 50 kbps.

2.2 SOFTWARE

The CAN protocol uses data frames for most communication. Remote frames are also enabled. The identifier field uses the standard frame definition length of 11 bits. All measurement data is transmitted using IEEE single-precision 32-bit format (IEEE 754) with most significant byte (MSB) sent first.

Bit Length	1	11	6	8 Bytes	16	2	7
	Start	Identifier	Control	Data Field	CRC	Ack	End

Figure 1. CAN data frame

2.2.1 Identifier

The identifier field has been split into two sections for Tritium devices. Bits 10-5 contain the device identifier and bits 4-0 contains the message identifier associated with that device, as shown in Figure 2. This means that there is a maximum of 64 Tritium devices that can be on the CAN bus at any one time. Each Tritium device can have 31 different types of messages, with the first message identifier being reserved as the device identification message.

10 … 5	4 … 0
DEVICE IDENTIFIER	MESSAGE IDENTIFIER

Figure 2. CAN device identifier address format

2.2.2 Data Field

The data field in all frames is fixed at 8 bytes (64 bits) and two IEEE 754 32-bit floating point variables as shown in Figure 3. The data field is sent and expected to be received least significant bite first. This allows a direct overlay of a float[2] array and char[8] array on a little endian processor, such as, an Intel x86 (or clone) or the TI MSP430 in the precharge controller.

High float

```
 s eeeeeeee mmmmmmmmmmmmmmmmmmmmmmm
 ^ ^      ^ ^                     ^
63 62    55 54                    32
```

Low float

```
 s eeeeeeee mmmmmmmmmmmmmmmmmmmmmmm
 ^ ^      ^ ^                     ^
31 30    23 22                    0
```

Figure 3. Format of the data field in a data frame

2.2.3 Units

Please note that variables described in the following packets with units of percent "%" should be sent with a minimum floating-point value of 0.0 and a maximum value of 1.0. Do not send 100.0 as the maximum value.

2.2.4 Broadcast Frames

These are data frames broadcast from the precharge controller to any listening device on the network. By default, the device ID and serial number is sent once per second to allow device auto-discovery, and status updates are sent when the status changes state.

2.2.5 Remote Frames

All frame types sent by the precharge controller may also be requested on demand by using the CAN bus remote frame transmit (RTR) mechanism. This is accomplished by the remote device transmitting a frame containing the address (ID) of the frame request, with the RTR bit set. The precharge controller will reply with the requested packet after a short delay.

3 OUTPUT MESSAGES

By default the CAN Precharge Controller uses a base address of 0x540.

3.1 IDENTIFICATION

3.1.1 Identification Information

ID: Precharge Controller Base Address + 0
Interval: 1 second

Variable	*Bits*	*Type*	*Description*
Serial Number	63 .. 32	Uint32	Device serial number, allocated at manufacture.
Tritium ID	31 .. 0	char[4]	"TRIe" stored as a string. msg[0] = 'T', msg[1] = 'R'...

The periodic broadcast of this message cannot be disabled. It is needed to help find the precharge controller on the network if the base address is lost or mis-configured by the user.

3.2 DEVICE STATE

3.2.1 Voltage

ID: Precharge Controller Base Address + 1
Interval: Only sent when RTR request is received

Variable	*Bits*	*Units*	*Description*
Centre Voltage	63 .. 32	Volts	The voltage measured on the battery pack side of the precharge contactor
Controller Voltage	31 .. 0	Volts	The voltage measured on the controller side of the precharge contactor

3.2.2 Temperature

ID: Precharge Controller Base Address + 2

Interval: Only sent when RTR request is received

Variable	*Bits*	*Units*	*Description*
External resistor	63 .. 32	°C	Temperature of the external precharge resistor
Internal PCB	31 .. 0	°C	Temperature of the internal circuit board

3.2.3 Operating State

ID: Precharge Controller Base Address + 3

Interval: Sent when operating state changes, or on RTR request

Variable	*Bits*	*Units*	*Description*
Unused	63 .. 16	–	–
Operating state	15 .. 8	–	Operating mode of the precharge state machine: 0 = ERROR 1 = IDLE 2 = MAIN 3 = PRECHARGE 4 = RUN
Unused	7 .. 3	–	–
Contactor 12V fault	2	–	Shows state of isolated supply to operate external contactors: 0 = OK, supply is present 1 = ERROR, supply is absent
Output 1 fault	1	–	Error in output 1 driver: 0 = OK 1 = ERROR
Output 2 fault	0	–	Error in output 2 driver: 0 = OK 1 = ERROR

4 INPUT MESSAGES

The CAN precharge controller observes the “Switch Position” packet sent from the CAN driver controls at default address 0x504. Bit 6 “Ignition ON” is used to control the state of the contactors and precharge/discharge operation.

5 REVISION RECORD

REV	*DATE*	*CHANGE*
1	24 February 2009	Document creation (JMK)