Shannon Way
Tewkesbury
Gloucester GL20 8ND
Ph: 011.44.1684.292333
Fx: 011.44.1684.297929

1000 Gamma Drive
Suite 206
Pittsburgh, PA 15238
Ph: 412.968.9744
Fx: 412.968.9746
www.triomotion.com

# TECHNICAL NOTE

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| **Subject:** | **Overview of CAN Control Protocol** |

## 1 - Introduction:-

This document is provided to give an overview of the functions implemented in the CAN Drive protocol between Trio Motion Coordinator and Infranor SMT-B range of drives.

The information is taken from the Infranor document “Communication protocol between NC and amplifiers via the CAN bus”. Details of the protocol definition are the property of Infranor Inter AG, Schaffhauserstrasse 418, Postfach, CH-8050 Zurich, Switzerland. This document may be copied provided that any copy made by whatever means contains the foregoing acknowledgement.

By the nature of an overview such as this, there may be errors and/or omissions in the details of this document. Trio Motion Technology Ltd., Trio Motion Technology LLC and any of our partners cannot be held responsible for the use of this information in any way, both commercially or technically. The inclusion of any feature in this document should not be taken to mean that it has been implemented. For example, “position error”, “Position error limit” and “position gain” parameters are not supported by the Motion Coordinator.

## 2 – Main Characteristics:-

- Conforms with CAN specification 2.0 part A
- Physical layer in conformity with the ISO 11898 standard up to 1Mbit/s
- Connector conforms to CiA recommendation DS-102, version 2.0
- Cyclic data transfer up to 1KHz
- Axes synchronized by means of Sync message
- Amplifiers addressable between addresses 1 and 15
- Motion Controller has address 0
- Control modes implemented : Speed

The Motion Coordinator and amplifier exchange messages on the CAN bus. There are 2 types of communication messages:

- Synchronous messages
- Asynchronous messages

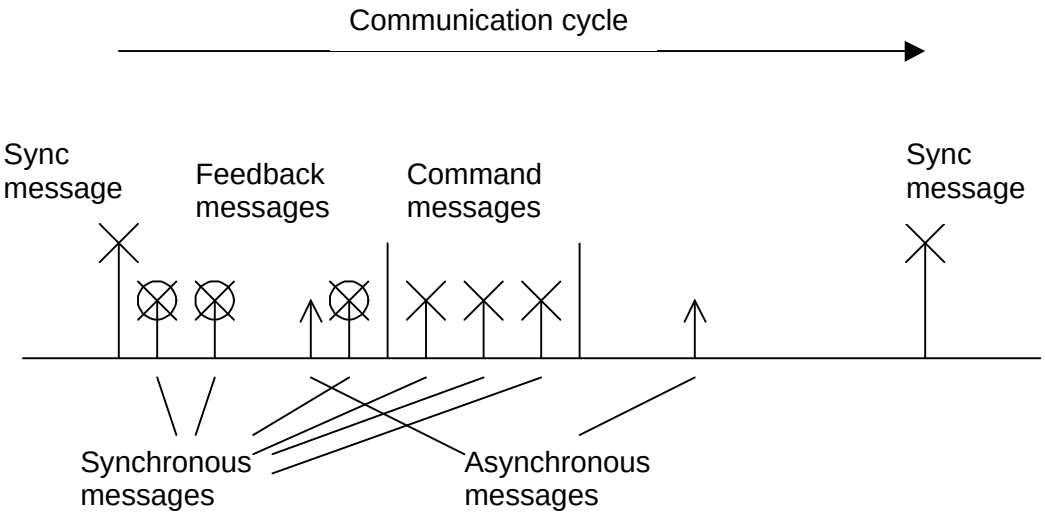
## 3 – Synchronous Messages:-

These are periodic messages such as speed commands or position signals.

There are 3 types of synchronous messages:

- Synchro message (m_sc)
- Control message (m_cmd)

- Feedback message (m_fb)




The Motion Coordinator sends a synchro message (m_sc) once per servo period to the amplifiers. On receipt of the m_sc, each amplifier sends its position message (m_fb) back to the Motion Coordinator. After reception of the positions, the Motion Coordinator sends the speed command messages (m_cmd) to the amplifiers.

## 4 – Asynchronous Messages:

These messages are used for the transmission of parameters between the Motion Coordinator and amplifiers. The transfer is initiated by the Motion Coordinator sending a m_request message which contains request type, amplifier address and any data to be written. A response message is sent by the amplifier either to confirm the transfer or to reply with any data requested.

Table of Asynchronous commands.

| Command Name | Cmd. byte | Description |
|---|---|---|
| Amplifier mode | 40 | Defines the amplifier operation mode (position, speed or torque) |
| Cycle time | 41 | Defines the cycle time of the Motion Coordinator. This value is necessary for the interpolation of position commands. (position mode not supported by Trio) |
| Configuration | 42 | Defines the configuration of the control (m_cmd) and feedback (m_fb) meesages. |
| Error threshold | 43 | Defines the error triggering threshold of the CANbus when the control synchro message (m_sc) or the control message (m_cmd) are missing. |
| Position resolution | 50 | Defines the feedback position resolution |
| Address | 51 | Used to check for the presence on the bus of the amplifier with this address. |
| Version | 52 | Returns the version number of the amplifier software and the amplifier manufacturer code. |
| Status | 53 | Returns the amplifier status |
| Speed/current mon | 54 | Returns the actual speed value and the actual current reading from the drive. |
| Rotation reversal | 60 | This command allows the reversal of the rotation direction with regard to the input command. It also reverses the position feedback |

| | | |
|---|---|---|
| | | input command. It also reverses the position feedback. |
| Maximum speed | 61 | Sets the maximum speed and speed scaling of the drive. |
| Absolute position | 62 | Returns the position value. |
| Position reset | 63 | Resets the position sent by the amplifier. |
| Position error | 64 | Returns the actual following error value when drive is in position mode. |
| Position error limit | 65 | Defines the position error alarm threshold value. |
| Motor parameters | 71 | Defines motor phase, resolver adjustment and number of pole pairs |
| Phase lead | 72 | Defines the phase lead in degrees per rpm |
| Maxumum current | 76 | Defines the current limit value for the motor |
| Rated current | 77 | Defines the rated current for the motor |
| $I^2t$ mode | 78 | Defines the mode 0 = limit, 1 = trip |
| Current limit | 79 | Defines the current limitation of the motor with regard to the value set by command 76 (max current). Values are 0 to 32767 (0 to 100%) |
| Poportional gain | 81 | Defines the proportional gain (KP2) of the speed loop. |
| Integral gain | 82 | Defines the integral gain (KI) of the speed loop. |
| Position gain | 83 | Defines the proportional gain of the position loop. |
| Anticipating term | 84 | Defines the value of KF which amplifies the derivative of successive position commands and applies the result as a velocity feed-forward term to reduce following errors. |
| Acceleration ramp | 85 | Defines the acceleration and deceleration ramp time of the motor. |
| Low pass filter | 86 | Defines the cut-off frequency of the first order filter acting on the current control. This value defines the required bandwidth. |
| Enable | 91 | Enable the amplifier |
| Disable | 92 | Disable the amplifier |
| Set defaults | 93 | Return all parameters to their default setting |
| Save to EEPROM | 94 | Save all amplifier parameters to EEPROM. |
| Auto-phasing | 95 | Starts the auto-phasing procedure to detect the number of pole pairs, the motor phase order and resolver offest. |
| Auto-tuning | 96 | Starts the auto-tune procedure to set up the speed loop. |

## 5 – Message Structure:

Synchronous messages have their CAN identifier made up as follows:

Synchro Messages : m_sc

Identifier m_scg1= 030h
Identifier m_srg1 = 040h

Command Messages : m_cmd

Identifier =

| 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|---|---|
| **0** | **0** | **0** | **0** | **1** | **1** | **0** | **Ad3** | **Ad2** | **Ad1** | **Ad0** |

[Ad3 Ad2 Ad1 Ad0] is the amplifier address (1 to 15)
Length of message is programmable

Feedback Messages : m_fb

Identifier =

| 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|---|---|
| **0** | **0** | **0** | **0** | **1** | **1** | **1** | **Ad3** | **Ad2** | **Ad1** | **Ad0** |

[Ad3 Ad2 Ad1 Ad0] is the amplifier address (1 to 15)
Length of message is programmable

Asynchronous messages have a single identifier allocated to request and another for reply. All amplifiers use the same identifiers, amplifier address selection is performed in the message body.

Message m_request:

Identifier = 0A0h

Message m_response:

Identifier = 0B0h

The data contained in asynchronous messages depends on the command number. Bytes 0 and 1 contain the command number, the target amplifier address and whether the operation is a read or a write.

Message m_request : Motion Coordinator to amplifier

| Identifier | Byte 0 | Byte 1 | Byte 2 | Byte 3 | Byte 4 | Byte 5 | Byte 6 | Byte 7 |
|---|---|---|---|---|---|---|---|---|
| 0x0A0 | Cmd | Acc | Data | Data | Data | Data | Data | Data |

Byte 1 : Access Mode

| 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|
| **L/E** | **T** | **0** | **0** | **Ad3** | **Ad2** | **Ad1** | **Ad0** |

L/E = 0 Read parameter
L/E = 1 Write parameter
T = 0 Target amplifier in defined by Ad3, Ad2, Ad1 and Ad0
T = 1 Broadcast to all amplifiers

Message m_response : Amplifier to Motion Coordinator

| Identifier | Byte 0 | Byte 1 | Byte 2 | Byte 3 | Byte 4 | Byte 5 | Byte 6 | Byte 7 |
|---|---|---|---|---|---|---|---|---|
| 0x0B0 | Cmd | Ad | Data | Data | Data | Data | Data | Data |

Byte 1 : Slave Address

| 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|
| **0** | **0** | **0** | **0** | **Ad3** | **Ad2** | **Ad1** | **Ad0** |