Using Tamagawa Encoders Application Note:

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Tamagawa Encoder

Overview

The Tamagawa Encoder is a battery backed up absolute encoder, and it provides an absolute 24bit position reading and encoder status. Agile Systems developed an interface to the Tamagawa Absolute Encoder.

Tamagawa Notes

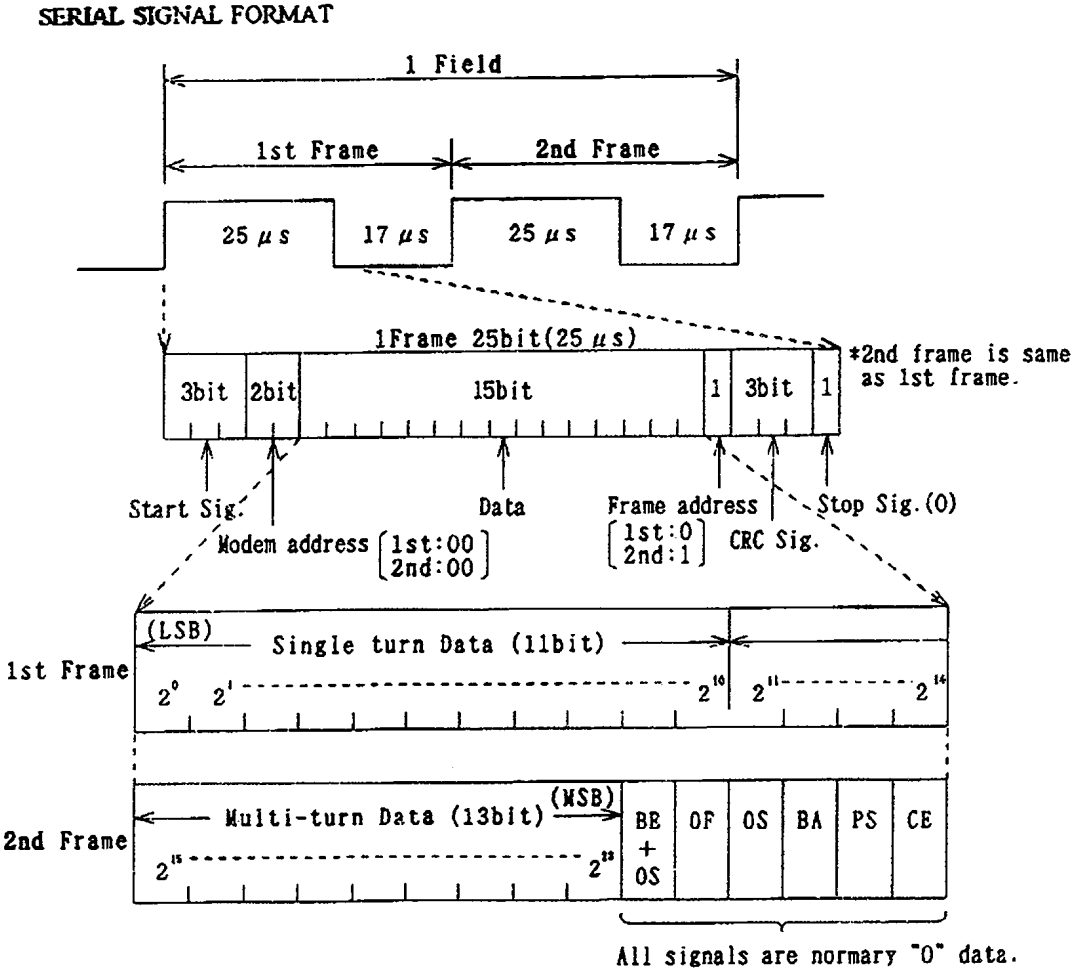
Once the Tamagawa encoder is connected to the Max3000 controller servo-ing a motor can follow the same procedure as a regular incremental encoder.

The differences to be aware of are:

1. Encoder will maintain position without the Max3000 being powered
2. Position Error is extrapolated from the Tamagawa update rate of 80us to the Max3000 sample rate of 50us.
3. Only having to align hall-less motors once or not at all if encoder has a known alignment with the rotor.

Serial Frame Format

The Tamagawa packet structure is shown below. The packets use Manchester encoding with CRC verification



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Hardware Specification

The interface to the Tamagawa Absolute Encodes has to meet certain hardware requirements to work properly. The table below outlines the specific requirements.

Description	Value
Tamagawa Output Voltage:	0 to +5V
Encoder Connection Serial Data Input	5V differential input to MAX3000 encoder A and /A
Tamagawa 2 packet 24bit update rate:	84 us
MAX3000 Controller Encoder Sample Rate:	50 us

Tamagawa Interface Hardware Specification

Software Specification

The Tamagawa Absolute encoder interface requires a number of software parameters to successfully set up the encoder.

1. Parameters for the Tamagawa Encoders
    - Absolute_Position_Offset_Hi Parameter 83: Value: 0
    - Absolute_Position_Offset Lo Parameter 84: Value: 0
    - Absolute_Alignment_Offset_Hi Parameter 85: Value: 0
    - Absolute_Alignment_Offset_Lo Parameter 86: Value: 0
    - Encoder_Type Parameter 87: Value: 2
2. Read Only Variables for the Tamagawa Encoders
    - Absolute_Encoder_Status

Note: To verify the parameters are set to the default state, use MAXWin to save the mapfile to hard disk. Use a standard TXT editor, count from the first parameter starting from 0, to the above parameter numbers.

Note: If the following parameters are not configured properly there can be unexpected values from the encoder feedback and commutation output.

Parameter and Variable Descriptions

Setting the Absolute offset

*Requires two parameters

- Absolute_Position_Offset_Hi
- Absolute_Position_Offset Lo

Parameter 1

Name:	Absolute offset 32 bit signed Long Number

Register ID:	83
Variable Type:	Parameter 1 & 2 combine to 32 bit signed long format
Scale:	1
Description:	Specifies the high 16 bits of the 32-bit value. Absolute offset value is added to the actual encoder absolute position to specify the users position. If the encoder is reading position 1 000 000 and the User wants this position to be 0 then the absolute offset should be set to –1 000 000. The value is read only at time of System Reset. Encoder Set Command sets the value.
In Mapfile:	Yes
Max/Min Values:	Combination of Parameter 1 & 2 between -2^31 and +2^31
Units:	Encoder Counts

Parameter 2

Name:	Absolute offset 32 bit signed Long Number
Register ID:	84
Variable Type:	Parameter 1 & 2 combine to 32 bit signed long format
Scale:	1
Description:	Specifies the low 16 bits of the 32-bit value.
In Mapfile:	Yes
Max/Min Values:	Combination of Parameter 1 & 2 between -2^31 and +2^31
Units:	Encoder Counts

Setting the Absolute Alignment offset

*Requires two parameters

- Absolute_Alignment_Offset_Hi
- Absolute_Alignment_Offset_Lo

Parameter 1

Name:	Absolute alignment offset: 32 bit signed Long Number
Register ID:	85

Variable Type:	Parameter 1 & 2 combine to 32 bit signed long format
Scale:	1
Description:	Specifies the high portion of the 32-bit value. Absolute alignment offset value is added to the single rotation absolute position to specify internal commutation angle. After a successful alignment the value is used to commutate motors without having to align the motors for every power cycle. The value is read only at time of System Reset. Motor Enable with a stator alignment request will set the value. The encoders can be positioned so that this value is always fixed (including 0 offset) so that alignment is never needed.
In Mapfile:	Yes
Max/Min Values:	Combination of Parameter 1 & 2 -2^31 to +2^31
Units:	Encoder Counts

Parameter 2

Name:	Absolute alignment offset: 32 bit signed Long Number
Register ID:	86
Variable Type:	Parameter 1 & 2 combine to 32 bit signed long format
Scale:	1
Description:	Specifies the low portion of the 32-bit value.
In Mapfile:	Yes
Max/Min Values:	Combination of Parameter 1 & 2 -2^31 to +2^31
Units:	Encoder Counts

Setting the Encoder Type

*Requires one parameter

- Encoder_Type

Parameter 1

Name:	**Encoder Type**: 16 bit enumerated Integer
Register ID:	87
Variable Type:	16 bit integer
Scale:	1

Description:	Specifies the type of Encoder being used. Enumerated to ▪ Standard incremental = 0 ▪ Yaskawa_encoded = 1 ▪ Tamagawa_absolute=2
In Mapfile:	Yes
Max/Min Values:	0 to 65535
Units:	None

Getting the Encoder Status

*Requires one variable

- Absolute_Encoder_Status

Variable 1

Name:	Absolute encoder Status: 16 bit binary
Register ID:	87
Variable Type:	16 bit integer
Scale:	1
Description:	Specifies the type of Encoder being used. Bits defined to: Controller generated Encoder Status Bits Bit 15 = ABS_ENCODER_NOT_PRESENT Encoder communications timed out during power up Bit 14 = ABS_ENCODER_RESET_FLAG Encoder is in controller generated reset sequence Bit 11 = ABS_ENCODER_COMMUNICATION_TIMEOUT Encoder Packets was not received in 250us during Position Loop Bit 6,7,8,9,10,12,13 Reserved Tamagawa generated Encoder Status Bits Bit 0 = Battery Error & Over-Speed (position lost) Bit 1 = Counter Over-Flow (24 bit data exceeded) Bit 2 = Over-Speed Bit 3 = Battery Alarm Bit 4 = Pre-Load Status Bit 5 = Count Error Status See (Tamagawa Document)

In Mapfile:	Yes
Max/Min Values:	0b to 0b1111111111111111
Units:	None

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