ADVANCED MOTION CONTROLS

RS 232/485 Protocol Examples

Introduction

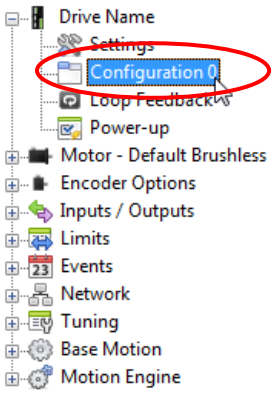
This application note gives examples on how to use the *ADVANCED* Motion Controls®, RS232/485 protocol for the DigiFlex® Performance™ series digital servo drives to control current, velocity or position. Use the Serial Communication Manual in conjunction with this App note, to get a good understanding of the RS232/485 Protocol.

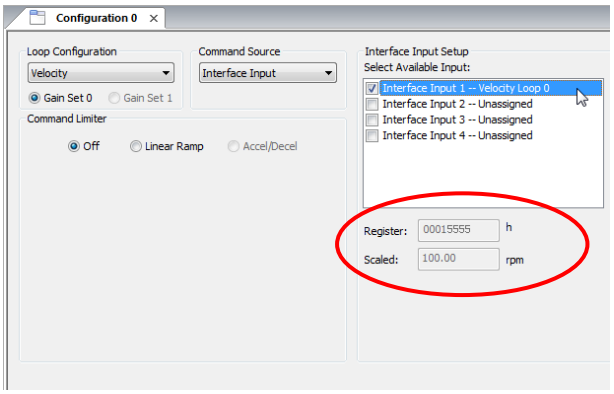
DriveWare

The first step is to connect to and set up the drive using *ADVANCED* Motion Controls' DriveWare software. The set up includes entering motor and feedback parameters, setting drive limits, tuning your current, velocity, and position loops, configuring I/O, etc. Refer to our DriveWare Quick Reference Guide for a walkthrough of the DriveWare setup.

Command Source

In DriveWare, set the command source to Interface Input 1. The Command Source options can be opened by clicking on the *Configuration* heading in the system setup panel. This sets the RS232/485 interface as the command source.





The *Interface Input Setup* panel displays the value that is currently being commanded over the RS232/485 interface. The commanded value is displayed along with the corresponding hex value stored in the drive.

Note: *The drive is configured for velocity mode in the above example. The Command Source window shows a Scaled velocity of 100RPM. 15555h is the actual value sent to the drive over the RS232/485 interface which corresponds to the 100RPM command. The velocity mode examples below show how the hex value is obtained.*

Important Objects

The following table lists the objects you will need to command and monitor current, velocity or position.

Index.Offset	Name	Size (words)
07.00h	Write- Access	1
01.00h	Bridge Control	1
45.00h	Command input	2
10.03h	Current Measured	1
11.02h	Velocity Measured	2
12.00h	Position Measured	2

Gain write-access

To gain write access to the drive, write an Fh to the Write-Access object 07.00h. Write access is required to change the state of the bridge and command motion to the motor. This only needs to be done once, prior to commanding the drive over the RS232/485 interface.

Send

SF	DA	CB	Ind.Off		L	CRC		Data		CRC	
A5	3F	02	07	00	01	B3	E7	0F	00	10	3E

Reply

SF	DA	CB	S1	S2	L	CRC	
A5	FF	00	01	00	00	CF	B6

Note: *By default, the drive gives you read-only access. Write-access is not needed if you're only going to be monitoring current, velocity, and/or position.*

How to Enable and Disable the Bridge

Note: *Make sure you have write access to the drive. If not, write an Fh to object 07.00h. See* ***Gain write-access*** *section for more help.*

Example 1 – Enable the bridge

Make sure there are no active faults disabling the bridge. To enable the bridge, write a 0h to object 01.00h.

Send

SF	DA	CB	Ind.Off		L	CRC		Data		CRC	
A5	3F	02	01	00	01	01	47	00	00	00	00

Reply

SF	DA	CB	S1	S2	L	CRC	
A5	FF	00	01	00	00	CF	B6

Example 2 – Disable the bridge

To disable the bridge, write a 1h to object 01.00h.

Send

SF	DA	CB	Ind.Off		L	CRC		Data		CRC	
A5	3F	02	01	00	01	01	47	01	00	33	31

Reply

SF	DA	CB	S1	S2	L	CRC	
A5	FF	00	01	00	00	CF	B6

Current Mode Examples

Make sure the drive is configured for current mode with the Command Source set to Interface Input 1. Enable the bridge and verify that there are no active faults inhibiting motion.

Drive Units

To convert from amps to drive units, multiply the number of amps by the scaling factor in the table below. To convert from drive units to amps, divide by the scaling factor.

Drive Unit Type	Physical Units	Scaling Factor
Current Target	Amps	$2^{15}/K_P$
Current Measured	Amps	$2^{13}/K_P$

Constant	Value
K_P	The maximum rated peak current of the drive in amps. For example, 15 for the DPRANIE-**015**A400.

***Note**: The Current Target and Current Measured objects have different scaling factors.*

Example 1 – Command 0.15 A of current on a DPRANIE-015A400

Convert 0.15 amps to drive units using the Current Target scaling factor

$$0.15amps \times \frac{2^{15}}{15APeak} = 327.68$$

Round to the nearest whole number and convert to hex

328 = 148h

***Note:** Make sure you have write access to the drive. If not, write an Fh to object 07.00h. See **Gain write-access** section for more help.*

Command 0.15 A by writing 148h to object 45.00h, the Command Input object.

Send

SF	DA	CB	Ind.Off		L	CRC		Data				CRC	
A5	3F	02	45	00	02	F0	49	48	01	00	00	DC	6F

Reply

SF	DA	CB	S1	S2	L	CRC	
A5	FF	00	01	00	00	CF	B6

Example 2 – Read current measured

Read Current Measured object 10.03h

Send

SF	DA	CB	Ind.Off		L	CRC	
A5	3F	01	10	03	01	BB	9B

Reply

SF	DA	CB	S1	S2	L	CRC		Data		CRC	
A5	FF	02	01	00	01	32	FF	56	00	A4	19

56h is the measured current data from 10.03h. Convert to decimal and divide by the Current Measured scaling factor to convert to amps.

56h = 86

$$\frac{86}{2^{13}/15} = 0.1574 \text{ amps} \cong 0.15 \text{ amps}$$

Velocity Mode Examples

Make sure the drive is configured for velocity mode with the Command Source set to Interface Input 1. Enable the bridge and verify that there are no active faults inhibiting motion.

Drive Units

To convert from velocity units to drive units, start with a velocity in counts/second then multiply by the scaling factor below. To convert from drive units to counts/second, divide by the scaling factor.

Drive Unit Type	Physical Units	Scaling Factor
Velocity	counts/s	$2^{17}/K_I K_S$

Constant	Value
K_I	Feedback interpolation value. Only applies to drives that support 1 V_{pp} Sin/Cos feedback. For all other drives, K_I = 1.
K_S	Switching frequency of the drive in Hz. This is found on the drive datasheet.

***Note:** The scaling factor for velocity target and velocity measured are the same.*

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Example 1 – Command 100 RPM on a motor with a 2000 line encoder using a drive with a 20KHz switching freq.

Convert 100 RPM to counts/second, then multiply by the Velocity scaling factor.

$$100\,{}^{rev}\!/_{\min} \times 8000\,{}^{counts}\!/_{rev} \times 1\,{}^{\min}\!/_{60\,\sec} = 13{,}333.33\,{}^{counts}\!/_{\sec}$$

$$13{,}333.33\,{}^{counts}\!/_{\sec} \times \frac{2^{17}}{20{,}000Hz} = 87381.311$$

Round to the nearest whole number and convert to hex.

87381 = 15555h

Note: *Make sure you have write access to the drive. If not, write an Fh to object 07.00h. See* ***Gain write-access*** *section for more help.*

Command 100 RPM by writing 15555h to object 45.00h

Send

SF	DA	CB	Ind.Off	L	CRC		Data				CRC	
A5	3F	02	45	00	02	F0	49	55	55	01	00	4F	71

Reply

SF	DA	CB	S1	S2	L	CRC	
A5	FF	00	01	00	00	CF	B6

Example 2 – Read Velocity Measured

Read Velocity Measured object 11.02h

Send

SF	DA	CB	Ind.Off	L	CRC	
A5	3F	01	11	02	02	8F	F9

Reply

SF	DA	CB	S1	S2	L	CRC		Data				CRC	
A5	FF	02	01	00	02	02	9C	FB	59	01	00	72	3C

159FBh is the velocity measured data from 11.02h. Convert to decimal and divide by the Velocity scaling factor to get velocity in counts/sec. Convert to RPM.

159FBh = 88,571

$$\frac{88{,}571}{\frac{2^{17}}{20{,}000Hz}} = 13{,}515\,{}^{counts}\!/_{\sec}$$

$$13{,}515\,{}^{counts}\!/_{\sec} \times \frac{1rev}{8000counts} \times \frac{60\,\sec}{\min} = 101RPM$$

$$\cong 100RPM$$

Position Mode Examples

Make sure the drive is configured for position mode with the Command Source set to Interface Input 1. Enable the bridge and verify that there are no active faults inhibiting motion.

Note: *Motor will move abruptly to the commanded position. Use the Command Profiler in DriveWare to limit velocity, accel and decel of the motor during position moves. See DriveWare help file for assistance with setting up the Command Profiler.*

Drive Units

The drive uses counts for position units.

Example 1 – Command a position of 10,000 counts

Convert 10,000 counts to hex: 10,000 = 2710h

Note: *Make sure you have write access to the drive. If not, write an Fh to object 07.00h. See* ***Gain write-access*** *section for more help.*

Command a position of 10,000 counts by writing 2710h to object 45.00h

Send

SF	DA	CB	Ind.Off		L	CRC		Data				CRC	
A5	3F	02	45	00	02	F0	49	10	27	00	00	18	F1

Reply

SF	DA	CB	S1	S2	L	CRC	
A5	FF	00	01	00	00	CF	B6

Example 2 – Read Position Measured

Read Position Measured object 12.00h

Send

SF	DA	CB	Ind.Off		L	CRC	
A5	3F	01	12	00	02	B0	CB

Reply

SF	DA	CB	S1	S2	L	CRC		Data				CRC	
A5	FF	02	01	00	02	02	9C	08	27	00	00	86	95

2708h is the position measured data read from 12.00h. Convert to decimal to get the number of position counts.

2708h = 9,992 counts ≅ 10,000 counts