



Tech Tips

Configuring/Using SynchLink

Description

This document serves as a supplement to the PowerFlex 700S Users Manual (20D-UM001A-EN-P) and the SynchLink Design Guide (1756-TD008A-EN-P) addressing items specific to PowerFlex 700S SynchLink. This document contains information specific to PowerFlex 700S SynchLink parameters and gives an example of setting up the PowerFlex 700S SynchLink using DriveExecutive. Please refer to the SynchLink Design Guide for details on the PF700S SynchLink topologies, hardware and wiring.

Technical Information

SynchLink data is transmitted as a combination of direct and buffered data. The following table shows the different formats supported by the PowerFlex 700S for transmit/receive data and the respective SynchLink fiber update rates for the direct and buffered data.

# of Direct Words	Direct Word Update	# of Buffered Words	Buffered Word Update
2	50 µSec	18	0.5 mSec
4	50 µSec	18	1 mSec
4	50 µSec	8	0.5 mSec

SynchLink Configuration

P1000 [SL Node Cnfg] is broken down into 3 bits:

- Bit 1 – “Time Keeper” – This bit is turned on in the SynchLink master. Only one node in a SynchLink network can be the time keeper.
- Bit 2 – “Reserved” – Not used.
- Bit 3 – “Synch Now” – Selecting this bit enables the “Synch Now” synchronization mode. This mode will cause the drive’s system clock to synchronize to the time keeper as quickly as possible. Deselecting this bit enables the “Synch Fast” synchronization mode. This method will take longer to synchronize the drive’s system clock to the time keeper, but has less impact on other tasks running in the drive. Synchronization only occurs on a drive power-up or initialization.

P1010 [SL Rx Comm Frmt] selects the format of data to be received. It can be set to:

- “0A, 0D, 0B” – No data.
- “0A, 2D, 18B” – 2 direct words and 18 buffered words.
- “0A, 4D, 8B” – 4 direct words and 8 buffered words.
- “0A, 4D, 18B” – 4 direct words and 18 buffered words.

Parameters 1011 [SL Rx DirectSel0] through 1014 [SL Rx DirectSel3] select what you want to do with received data. The most common settings for these parameters are

- “No Data” – SynchLink received data is passed straight through.
- “SL Multiply” – See details on multiply block.

P1020 [SL Tx Comm Frmt] selects the format of data to be transmitted. It can be set to:

- “0A, 0D, 0B” – No data.
- “0A, 2D, 18B” – 2 direct words and 18 buffered words.
- “0A, 4D, 8B” – 4 direct words and 8 buffered words.
- “0A, 4D, 18B” – 4 direct words and 18 buffered words.





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Parameters 1021 [SL Tx DirectSel0] through 1024 [SL Tx DirectSel3] select what transmit data you wish to send. The most common settings for these parameters are

“No Data” – No data is selected for that transmit word.

“Dir Tx Data” – Use this selection to transmit a parameter.

SynchLink Direct Data:

Direct Data Transmit Parameters

P1140 [Tx Dir Data Type] bits 0 through 3 select whether the direct data words transmitted over SynchLink will be integer or floating-point. When the bit is turned off, it means the data transmitted will be integer. When the bit is turned on, it means the data transmitted will be floating-point.

Odd parameters 1141 [SL Dir Int Tx0] through 1147 [SL Dir Int Tx3] contain the integer values for data transmitted to SynchLink. These parameters can be linked to integer source parameters.

Even parameters 1142 [SL Dir Real Tx0] through 1148 [SL Dir Real Tx3] contain the floating point values for data transmitted to SynchLink. These parameters can be linked to floating-point source parameters.

Direct Data Receive Parameters

Even parameters 1054 [SL Dir Int Rx0] through 1060 [SL Dir Int Rx3] contain the integer values for data received from SynchLink. An integer destination parameter can be linked to these parameters.

Odd parameters 1055 [SL Dir Real Rx0] through 1061 [SL Dir Real Rx3] contain the floating point values for data received from SynchLink. A floating-point destination parameter can be linked to these parameters.

Multiply Block:

SynchLink has the ability to take one of the direct data words received from Synchlink and multiply it by a constant or parameter value for features such as draw control. The multiply function is handled at the hardware level to ensure the highest possible execution speeds. Because of this, the multiply function is integer based.

Preparing Floating-Point Data in the Transmitting Drive

If the received data to be multiplied is floating point, it must first be converted from floating point to integer in the transmitting drive. A floating point to integer conversion has been provided for this purpose.

P1032 [SL Mult Base] sets the value to multiply P1035 [Real to Int In] before sending it out SynchLink. Make sure this parameter is set appropriately so that the integer value sent across SynchLink has enough resolution.

P1034 [SL Mult State] contains overflow bits if the data for the multiply block is too large. It is broken down into the following bits:

Bit 0 – “Local Overflow” - The result of the multiply function is too large.

Bit 1 – “Rx Overflow”- The data received from SynchLink is too large.

Bit 2 – Not used

Bit 3 – “FtoI Overflow” – In the transmitting drive, the data converted from floating point to integer is too large.

P1035 [Real to Int In] is linked to the parameter that you want to multiply.



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P1036 [Real to Int Out] contains the integer value sent over SynchLink. One of the SynchLink direct integer transmit words (parameter 1141, 1143, 1145, or 1147) must be linked to P1036 to send the value over SynchLink.

For example, to use the multiply block to scale the s-curved speed reference and send it over SynchLink, link P1036 [Real to Int In] to P43 [S Curve Spd Ref]. Set P1032 [SL Mult Base] to 10,000. Then link P1141 [SL Dir Int Tx0] to P1036 [Real to Int Out].

Configuring the Multiply Block in the Receiving Drive

Select which received direct word to use the multiply block on by setting one of the following parameters: P1011 [SL Rx DirectSel0], P1012 [SL Rx DirectSel1], P1013 [SL Rx DirectSel2], or P1014 [SL Rx DirectSel4] to “SL Multiply”. The receive parameter selected to multiply in the receiving drive must correspond to the transmit parameter selected to be multiplied from the transmitting drive. The result of the multiply function can be used in the receiving drive, or transmitted directly to another drive.

P1030 [SL Mult A In] contains the value received from SynchLink, after it was divided by P1032 [SL Mult Base].

P1031 [SL Mult B In] contains the multiply scale factor to multiply by the value received from SynchLink. Note that P1031 could be a constant or linked to a source parameter.

P1032 [SL Mult Base] contains the base to convert integer data received from SynchLink back to floating-point data. Usually, P1032 [SL Mult Base] will be set the same in the transmitting and receiving drive.

P1033 [SL Mult Out] contains the result of the multiply block. A destination parameter can be linked to P1033 [SL Mult Out].

P1034 [SL Mult State] contains overflow bits if the data for the multiply block is too large. It is broken down into the following bits:

Bit 0 – “Local Overflow” - The result of the multiply function is too large.

Bit 1 – “Rx Overflow” - The data received from SynchLink is too large.

Bit 2 – Not used

Bit 3 – “FtoI Overflow” – In the transmitting drive, the data converted from floating point to integer is too large.

For example, to receive the s-curved speed reference from the transmitting drive and scale it by 0.5, set P1011 [SL Rx DirectSel 0] to “SL Multiply”. Set P1031 [SL Mult B In] to 0.5. Set P1032 [SL Mult Base] to 10,000. Link P37 [Spd Ref Bypass] to P1033 [SL Mult Out].

Buffered Data:

Buffered Data Transmit Parameters

P1160 [Tx Buf Data Type], bits 0 through 29, select whether each word of buffered data that is transmitted is integer or floating-point. When the bit is turned off, it means the data transmitted will be integer. When the bit is turned on, it means the data transmitted will be floating-point.

Odd parameters 1161 [SL Buf Int Tx00] through 1219 [SL Buf Int Tx29] are linked to integer parameters that you want to send out SynchLink as buffered data. Note that at this time, the maximum number of buffered words that can be sent over SynchLink is 18, so only odd parameters 1161 [SL Buf Int Tx00] through 1195 [SL Buf Int Tx17] would be used.



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Even parameters 1162 [SL Buf Real Tx00] through 1220 [SL Buf Real Tx29] are linked to floating-point parameters that you want to send out SynchLink as buffered data. Note that at this time, the maximum number of buffered words that can be sent over SynchLink is 18, so only odd parameters 1162 [SL Buf Real Tx00] through 1196 [SL Buf Real Tx17] would be used.

Buffered Data Receive Parameters

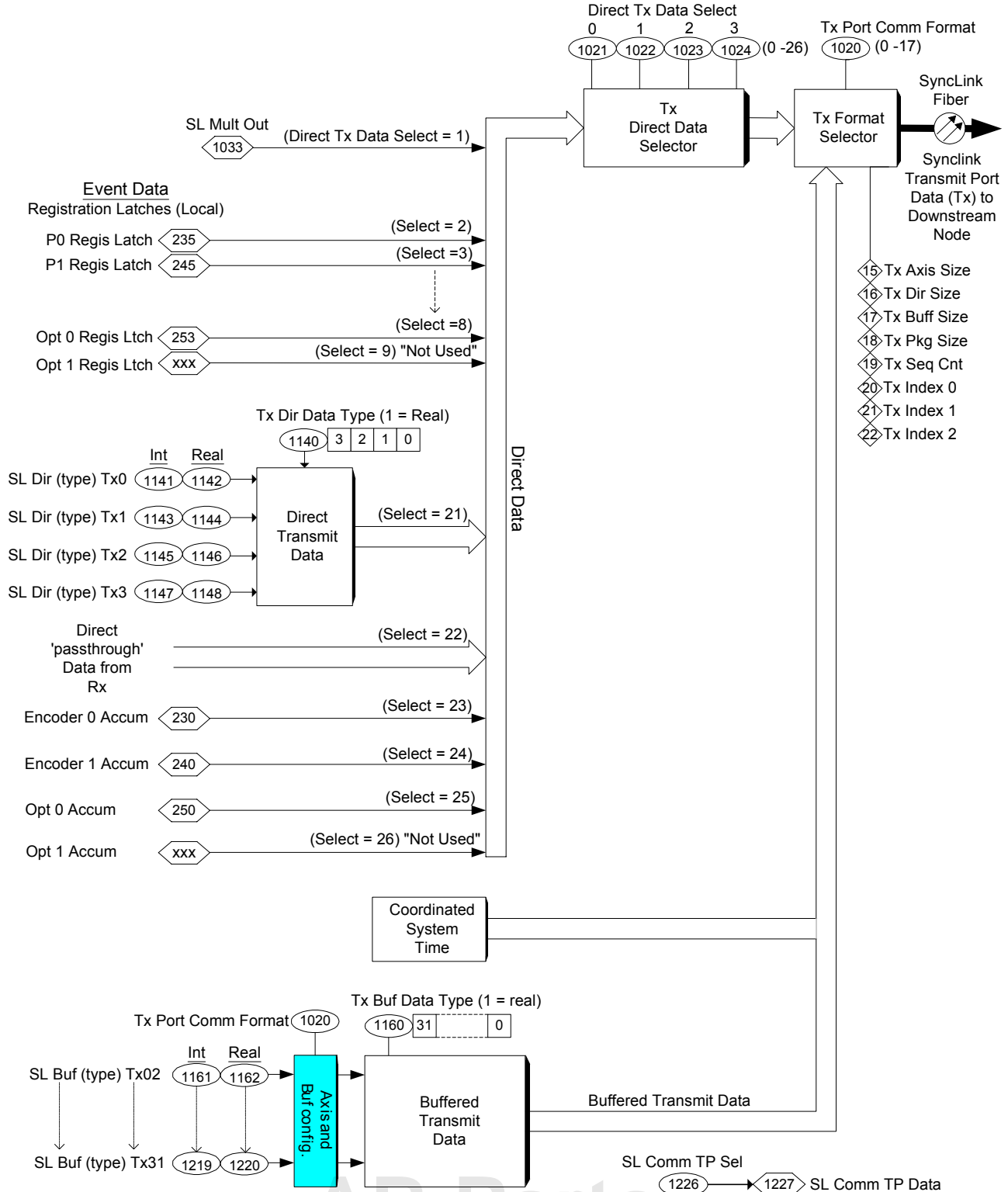
Odd parameters 1073 [SL Buf Int Rx00] through 1131 [SL Buf Int Rx29] contain integer values that you receive from SynchLink as buffered data. Destination parameters that are integers can be linked to this buffered data. Note that at this time, the maximum number of buffered words that can be received over SynchLink is 18, so only odd parameters 1073 [SL Buf Int Rx00] through 1107 [SL Buf Int Rx17] would be used.

Even parameters 1074 [SL Buf Real Rx00] through 1132 [SL Buf Real Rx29] contain floating-point values that you receive from SynchLink as buffered data. Destination parameters that are floating-point values can be linked to this buffered data. Note that at this time, the maximum number of buffered words that can be received over SynchLink is 18, so only even parameters 1074 [SL Buf Real Rx00] through 1108 [SL Buf Real Rx17] would be used.



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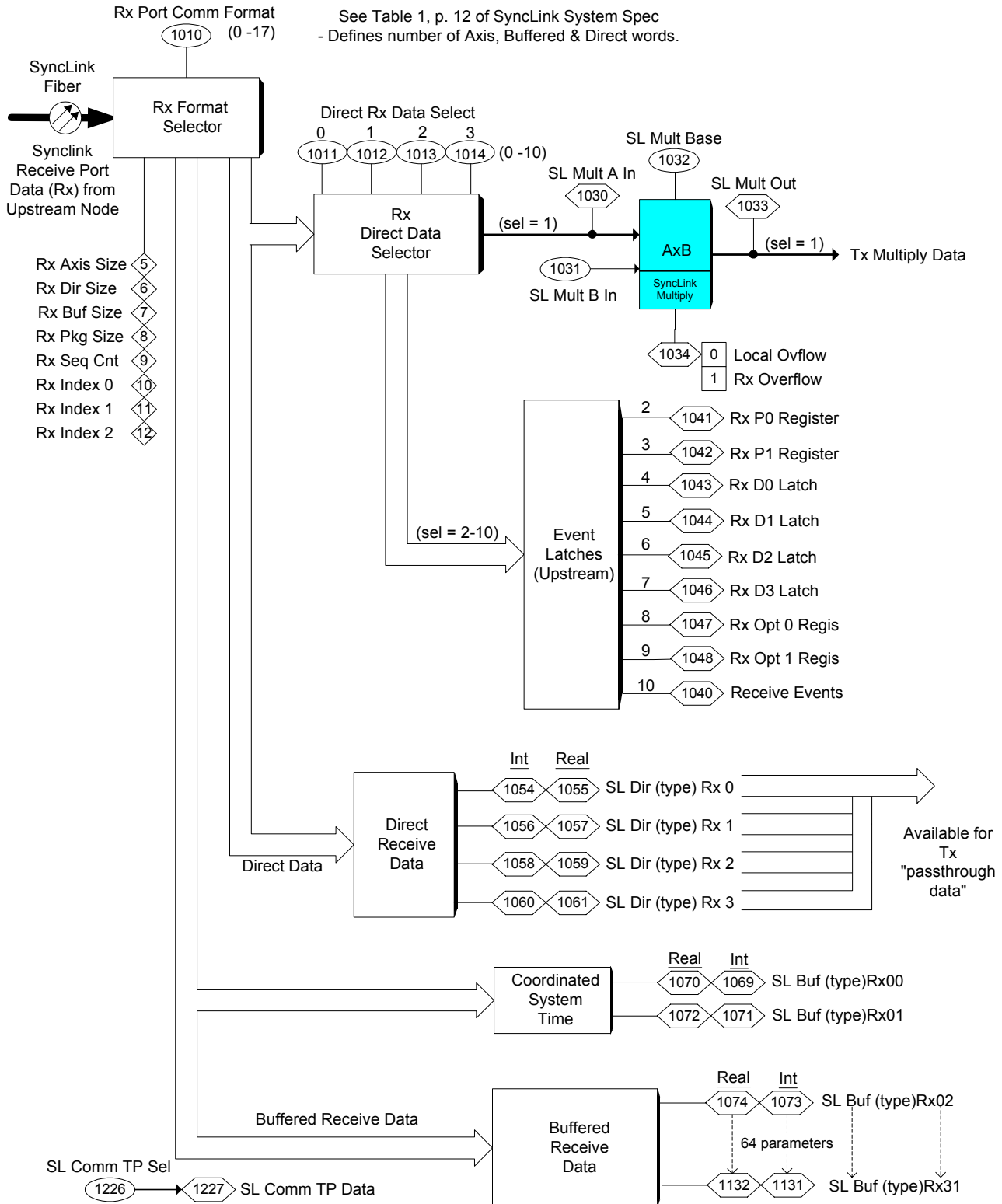
Figure 1 - SynchLink Transmit Block Diagram





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Figure 2 - SynchLink Receive Block Diagram



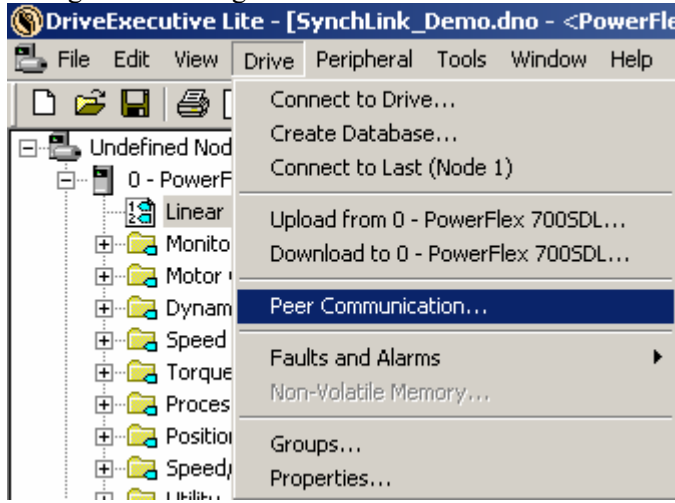


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Speed Synchronization Example:

This example will go through how to setup SynchLink to synchronize the ramped, s-curved speed reference for (2) PowerFlex 700S drives using DriveExecutive. Note that the “Peer Communication” setup in DriveExecutive configures the appropriate SynchLink parameters for you as you go through the setup.

Once connected to the drive, click on “Drive, and then “Peer Communication” to get to the SynchLink configuration dialog box.



A dialog box similar to the one shown will appear. This is the dialog box used to setup SynchLink communication.



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The screenshot shows the 'PowerFlex 700SDL Peer Communication Setup' dialog box. It has two tabs: 'SynchLink Setup' (selected) and 'From Controller | To Controller'. Under 'SynchLink Setup', there are two dropdown menus: 'SynchLink Receive Format' set to 'No Receive Data' and 'SynchLink Transmit Format' set to 'No Transmit Data'. Below these are two sections: 'Multiplier Block Setup' and 'Transmitted Direct Words'. 'Multiplier Block Setup' includes 'Receive word to multiply' (None), 'Multiplier Base Value' (10000.000000), 'Multiplier Value' (1.000000), and 'Source Parameter' (None). 'Transmitted Direct Words' is a table with 4 rows and 2 columns: 'Source' and 'Item', all set to 'No Data'. A 'SynchLink Node Configuration' button is located below the 'Transmitted Direct Words' section. Below that is a 'Transmitted Buffered Data (parameter values)' section with a 10x3 grid of dropdown menus, all set to '(None)'. At the bottom are 'OK' and 'Cancel' buttons.

Master PowerFlex 700S Drive Setup (Transmitting Drive)

In the master, or transmitting drive, select the SynchLink Transmit format. For this example, select “4 Direct Words, 8 Buffered Words”.



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For Transmitted Direct Word 0, select “Drive Parameter” for the Source and P43[S Curve Spd Ref] for the Item.

PowerFlex 700SDL Peer Communication Setup

SynchLink Setup | From Controller | To Controller

SynchLink Receive Format: No Receive Data

SynchLink Transmit Format: 4 Direct Words, 8 Buffered Words

Multiplier Block Setup:

Receive word to multiply: None

Multiplier Base Value: 1.0000.000000

Multiplier Value: 1.000000

Source Parameter: (None)

Transmitted Direct Words:

	Source:	Item:
0:	Drive Parameter	43 - S Curve Spd Ref
1:	No Data	No Data
2:	No Data	No Data
3:	No Data	No Data

SynchLink Node Configuration

Transmitted Buffered Data (parameter values):

Word	Value	Value	Value
Word 0	(None)	(None)	(None)
Word 1	(None)	(None)	(None)
Word 2	(None)	(None)	(None)
Word 3	(None)	(None)	(None)
Word 4	(None)	(None)	(None)
Word 5	(None)	(None)	(None)
Word 6	(None)	(None)	(None)
Word 7	(None)	(None)	(None)
	(None)	(None)	(None)
	(None)	(None)	(None)

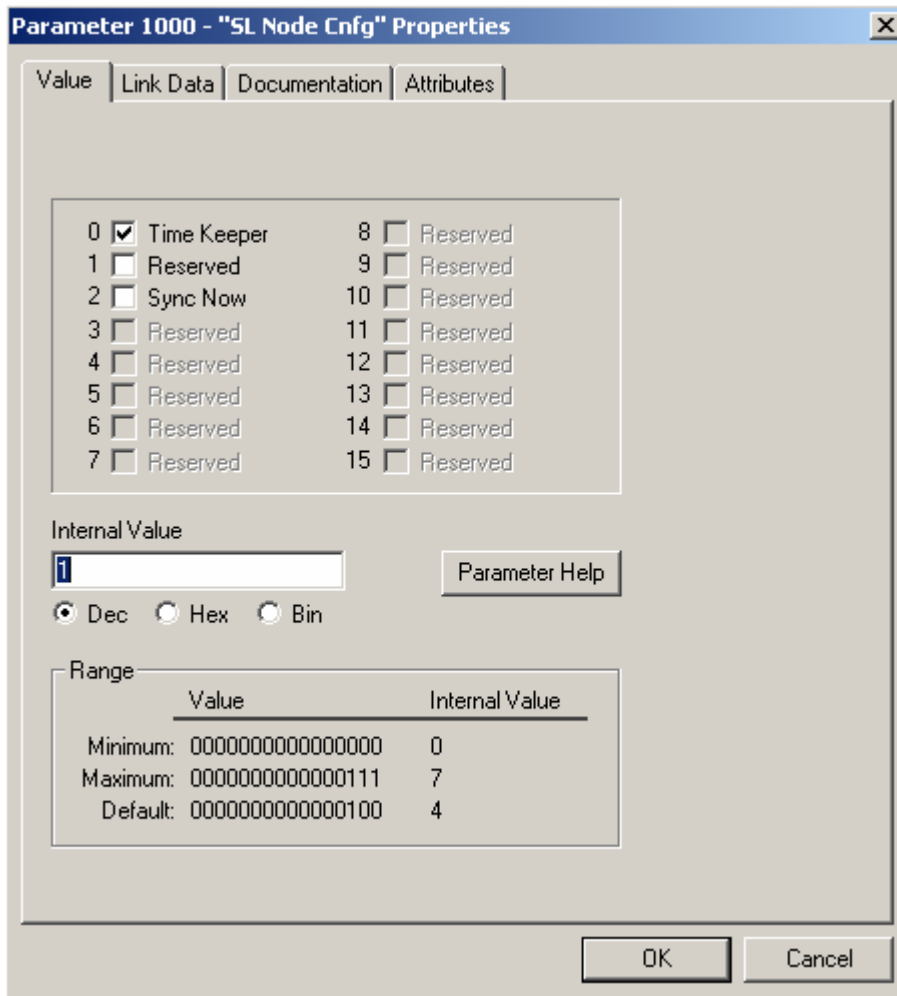
OK Cancel

Click **SynchLink Node Configuration** and a dialog box appears.

Uncheck “Sync Now” and check the “Time Keeper” box. The master drive is now the Time Keeper for SynchLink.



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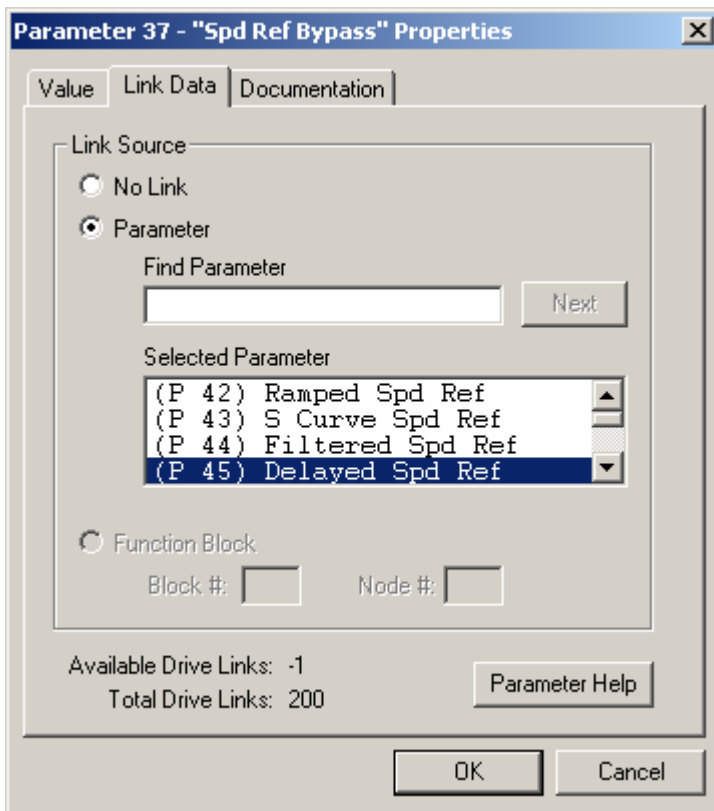


Click “OK” twice to accept the settings and close the dialog boxes for Peer Communication.

To synchronize the speed references, we must add a time delay to the S-Curve Spd Ref of the master. To do this link P37 [Spd Ref Bypass] to P45 [Delayed Spd Ref].



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Follower PowerFlex 700S Setup (Receiving Drive)

In the follower drive, select the SynchLink Receive Format to match the size of the data transmitted from the master. For this example, select “4 Direct Words, 8 Buffered Words”.

If desired, the multiply block can be used to change the scaling of one of the Direct Words coming from the master to the follower. For example, the multiply might be used to enter a gear ratio for the speed reference.



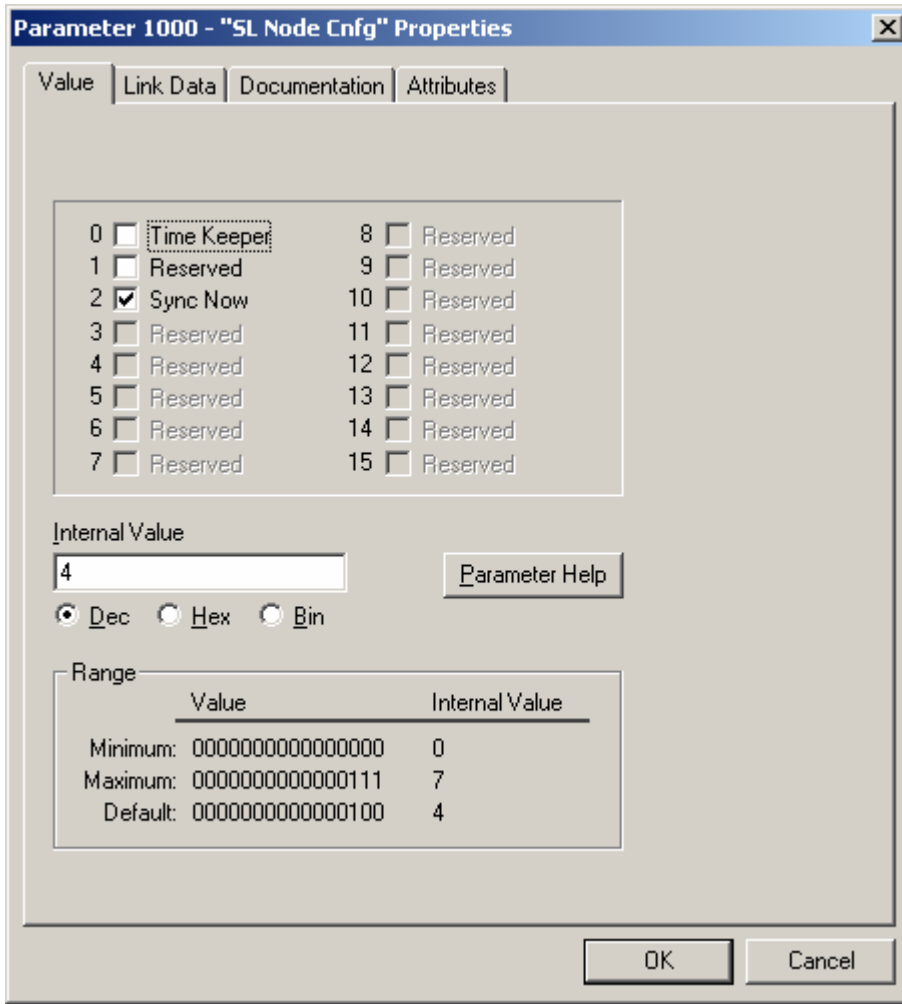
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The screenshot shows the 'PowerFlex 700SDL Peer Communication Setup' dialog box. It has a title bar with a close button. Below the title bar are two tabs: 'SynchLink Setup' (selected) and 'From Controller'. Under 'SynchLink Setup', there are two dropdown menus: 'SynchLink Receive Format' set to '4 Direct Words, 8 Buffered Words' and 'SynchLink Transmit Format' set to 'No Transmit Data'. Below these are two sections: 'Multiplier Block Setup' and 'Transmitted Direct Words'. 'Multiplier Block Setup' includes 'Receive word to multiply' (None), 'Multiplier Base Value' (10000.000000), 'Multiplier Value' (1.000000), and 'Source Parameter' ((None)). 'Transmitted Direct Words' is a table with 4 rows and 2 columns: 'Source' and 'Item', all set to 'No Data'. At the bottom right is a 'SynchLink Node Configuration' button. Below this is a section for 'Transmitted Buffered Data (parameter values)' with a 10x3 grid of dropdown menus, all set to '(None)'. At the bottom are 'OK' and 'Cancel' buttons.

Click **SynchLink Node Configuration** and a dialog box appears. Verify that only the “Sync Now” box is checked (this is factory default).



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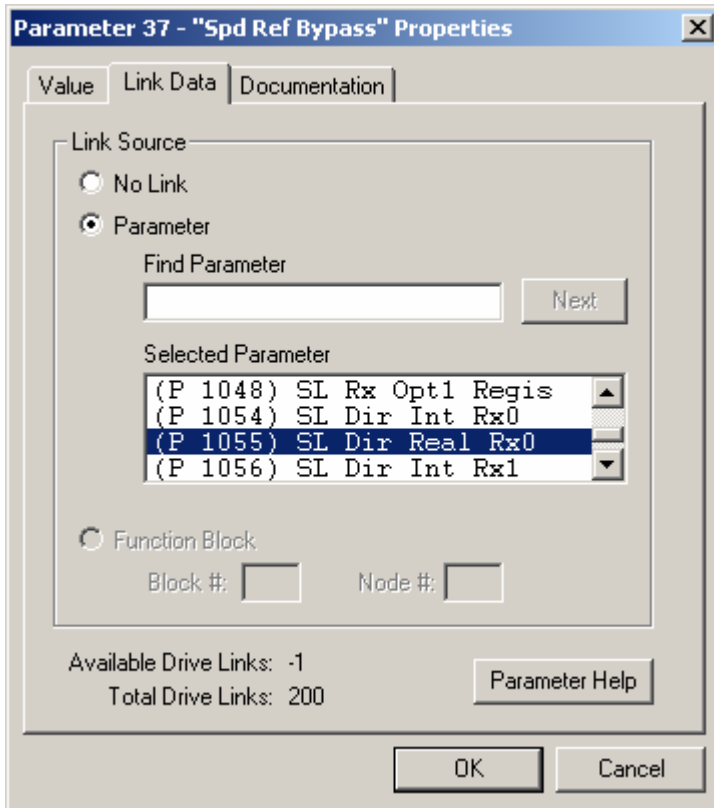


Click “OK” twice to accept the settings and close the dialog boxes for Peer Communication.

Now we must link the Spd Ref Bypass of the follower to Word 0 of Direct Data coming over SynchLink. To do this, link P37 [Spd Ref Bypass] to P1055 [SL Dir Real Rx0].



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Note that by linking to Spd Ref Bypass of the follower, we bypassed the ramp and s-curve of the follower. This is because the reference is already ramped and s-curved by the master. This way, both drives follow exactly the same ramp.

Cycle Power

- You must power down all drives before SynchLink changes take effect.
- Apply power to the master first. The SynchLink LED should be solid green. The SynchLink LED is on the top right of the MCB and is visible through the window on the control assembly.
- When power is applied to the follower(s) the SynchLink LED on the follower should be solid in about 1 minute.