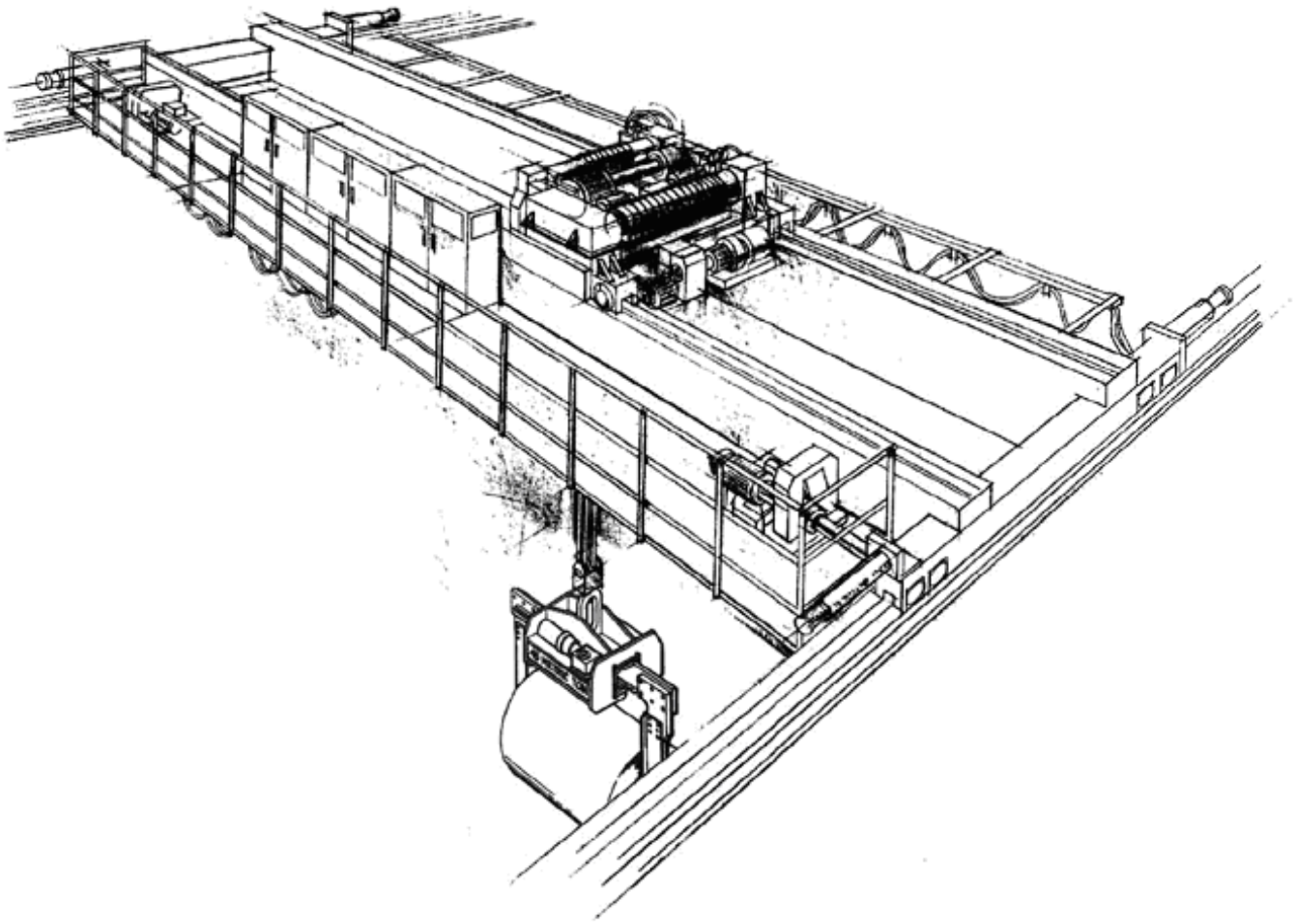

Sway Control System - Series 2

(SCS–S2) Programming Manual

MAGNETEK
MATERIAL HANDLING

Software #8160.2 November 2009
Part Number: 140-10455

Rev 1
Addendum to G+ Series 3(140-10258) and
VG+ Series 3 (140-10257) manuals.

DANGER, WARNING, CAUTION,* and *NOTE

Statements
DANGER, WARNING, CAUTION, and *Note* statements maybe used in this manual to emphasize important and critical information. You must read these statements to help ensure safety and to prevent product damage.

***NOTE**: A NOTE statement is used to notify of installation, operation, programming, or maintenance information that is important, but not hazard-related.*

Warning
Improper programming of a drive can lead to unexpected, undesirable, or unsafe operation or performance of the drive.

Disclaimer of Warranty
Magnetek hereafter referred to as Company, assumes no responsibility for improper programming of a drive by untrained personnel. A drive should only be programmed by a trained technician who has read and understands the contents of this manual. Improper programming of a drive can lead to unexpected, undesirable, or unsafe operation or performance of the drive. This may result in damage to equipment or personal injury. Company shall not be liable for economic loss, property damage, or other consequential damages or physical injury sustained by the purchaser or by any third party as a result of such programming. Company neither assumes nor authorizes any other person to assume for Company any other liability in connection with the sale or use of this product.

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Introduction to Sway Control System - Series 2

Sway Control System is a method to greatly reduce the amount of unwanted swing when moving suspended loads. It works by taking advantage of the fact that a suspended load behaves as a pendulum. Control methods can be introduced that estimate how the system will react to movement, and dampen out unwanted swing. In a typical application, more than 90% of the swing can be removed. Less swing translates into increased productivity and a safer work environment. Acceleration times can be shorter, and personnel are not required on the ground to stop a swinging load.

Only two elements are needed for Sway Control to work properly, the distance from the drum to the center of gravity (C.G.) of the load, and the speed of the traverse movement. Because Sway Control is an embedded feature of the traverse drives, the exact speed is already known. The distance from the drum to the center of gravity is determined using various methods. Typically an IMPULSE•VG+^{TM} Series 3 drive on the Hoist movement automatically determines the distance from the geared upper limit (UL2) to the hook, and a dial is provided to the operator for fine tuning.

Features of this software are listed below and explained in further detail throughout this document:

- Control is applied only to traverse motions. Only one drive per motion is required to have Sway Control firmware.
- V/F, Open Loop Vector and Flux Vector control methods available.
- Supported on IMPULSE•G+^{TM} Series 3 drives.
- All speed input methods available.
- MicroSpeed movements can disable Sway Control for better control at low speeds.
- Enable / Disable Sway Control by multi-function digital input.
- Automatic hook height measurement when using a IMPULSE•VG+^{TM} Series 3 Hoist drive.
- Various methods provided to fine tune the swing height by operator. Any combination of inputs can be used to provide the most flexibility when configuring system.
- Custom Acceleration / Deceleration times in Sway Control mode.
- Reverse Plug functionality for faster direction switching.

There are certain limitations to the Sway Control System. For more information, see Sway Control System Limitations on page 12.

Terminology

AI – Analog Input

C.G. – Center of Gravity (or Center of Mass), usually the middle most point of an object, if the object were to be quickly rotated, the Center of Gravity is the point about which it would rotate

C.G. Offset – Manually entered, fine tuning adjustment by the operator to include the distance from the hook to the C.G. of the load.

Const. Offset – Distance from the center of the Drum to the highest (0%) position of the hook.

Hook Height – A value from the hoist drive, input by the traverse drives as an analog voltage that represents the position of the hook as a percentage from the highest (0%) and lowest (100%) positions. This is not to be confused with Swing Length, which is the total length from the center of the drum, to the center of gravity of the load.

MFAI – Multi Function Analog Input. Used for various purposes including speed reference, sling length and hook height.

MFDI – Multi Function Digital Input. Used for enabling and disabling Sway Control. Also used for sling length adjustments, limit switches etc.

SCS-S2: Sway Control System, Series 2.

Swing Length – Total distance from the Center of Gravity of the load, to the drum.

Sway Control System – Optional feature of IMPULSE•G+™ Series 3 drives that reduces the amount of induced load swing.

Terminals A1, A2 & A3 – Analog Inputs on all IMPULSE•VG+™ and G+ Series 3 drives.

UL1, LL1 – Upper and Lower Limit 1. Slow Down positions of the hook travel.

UL2, LL2 – Upper and Lower Limit 2. The hook has reached the end of travel. When lifting and UL2 is reached, only lowering is possible. When lowering and LL2 is reached, only lifting is possible.

UL3 – Upper Limit 3. Typically a weighted limit switch. Drive will fault and require resetting if the hook is lifted to this point.

Sway Control Parameters

Configuration Parameters

Parameter	Name	Content	Range	Default
A1-03	Motion Selection	Application Motion. 0: Traverse	0	0
B3-03	Stop Method	Stopping method when the run command is removed. 0: Decel to stop 4: Decel w/ timer	0, 4	0
C14-01	Sway Ctrl Sel	0: Sway Ctrl disabled 1: Always Enabled 2: Enabled by MFDI = 1E	0 ~ 2	0
C14-02	Hook Height	Distance from UL3 to hook	0 ~ 100 ft (C14-10 = 0) 0~300 ft (C14-10 = 1)	25
C14-03	Const. Offset	Distance from Drum to UL3	0 ~ 20ft	5
C14-04	CG Offset MFDI	Size of each step for the additional offset input by MFDI (H1–0x = 69H ~ 6CH)	0 ~ 10 ft (C14-10 = 0) 0~20 ft (C14-10 = 1)	1
C14-05	CG Offset by AI	Additional Swing Length by Analog Input (H3-0x)	0 ~ 10 ft (C14-10 = 0) 0~30 ft (C14-10 = 1)	1
C14-06	Sway Ctrl Accel	Accel time when Sway Ctrl is enabled	0 ~ 25.5s	5.0
C14-07	Sway Ctrl Decel	Decel time when Sway Ctrl is enabled	0 ~ 25.5s	5.0
C14-08	Disable in M.S.	Disable Sway Ctrl when Microspeed 1 or 2 is on. With this enabled, the motor must be stopped to enter Microspeed mode. 0: No 1: Yes	0 ~ 1	0
C14-09	Alt Swing Length	Force Swing Length to a single value by MFDI = 6D.	0 ~ 100 ft (C14-10 = 0) 0~300 ft (C14-10 = 1)	20
C14-10	Swing Len Range	Switch the maximum swing length. Setting of 0 to 100 ft will minimize sway. Setting of 0 to 300 ft will be more responsive, but result in more sway 0: 0 to 100ft 1: 0 to 300ft	0 ~ 1	0

I/O Parameters

Parameter	Name	Content
H1-0x = 1EH	Sway Ctrl 0/1*	Enable Sway Control when C14-01 set to 2 (Enabled by MFDI). Motor must come to complete stop before Sway Control can be enabled or disabled.
H1-0x = 69H ~ 6CH	GC Offset	Offset by binary input. The four inputs are used to generate a number from 0 to 15. The Input assigned to 69H is used as the Least Significant Bit. 6AH is the 2nd bit, 6BH is the 3rd bit, and 6CH is the 4th bit.
H1-0x = 6DH	Use Alt Swng Len*	Use alternate swing length defined by C14-09
H2-0x = 3DH	SCS Enabled	Output activated when Sway Control is enabled.
H3-0x = 17H	Hook Height	0V = 0% of C14-02 Added to Swing Length 10V = 100% of C14-02 Added to Swing Length
H3-0x = 18H	Cen Grav Offset	1V = C14-05 Added to Swing Length 10V = 10 * C14-05 Added to Swing Length
* Cannot switch while running		

Monitor Parameters

Parameter	Name	Content
U1-01	Frequency Reference	Current target frequency
U1-02	Output Frequency	Current output frequency
U1-50 *	Hook Height	(Hoist Only) Percentage of hook height is displayed.
U1-52 *	Motor Revolution	(Hoist Only) Number of Motor Revolutions since UL2
U1-62	Swing Length	Computed Swing Length. This is the distance from the Drum to the Center of Gravity of the load. The maximum Swing Length is 100 feet.
* Available only when using an IMPULSE•VG+™ Series 3 Hoist VFD		

Alarms

Parameter	Name	Content
SCS1	Rope Too Long	The calculated Swing Length is greater than the maximum of 100 feet. Check the Multi Function Digital Input and Multi Function Analog Input scaling factors.

Setting up a Sway Control System

The preferred configuration for the Sway Control feature includes an IMPULSE•VG+™ Series 3 drive on the hoist. With this configuration the height of the hook can be automatically relayed from the Hoist to the Traverse drives. Without an IMPULSE•VG+™ Series 3 Hoist drive, the hook height is not automatically known. This is because there is no encoder on the motor. In this configuration, it is suggested that the load be lifted to a predetermined height when moved.

Setting up general parameters

1) Determine how Sway Control will be enabled. If the operator will always be using Sway Control, set C14-01 to 1 'Always Enabled.' For more flexibility, set C14-01 to 2 'Enabled by MFDI.' This will allow the operator to choose when Sway Control is enabled. A switch must be wired to an input on the Bridge and Trolley drives, and an MFDI set to 1E.

2) Determine Accel / Decel times. The value entered determines the aggressiveness of the acceleration, not the actual time required to reach full speed. The Sway Control calculation will add up to a few seconds depending on the Swing Length. Enter the desired times into C14-06 and C14-07.

3) Determine how, and if, the CG Offset will be entered. The CG Offset is the distance from the hook to the Center of Gravity of the load.
   a. CG Offset by MFDI – Enter the distance multiplier (in feet) into C14-04. Wire and program four multi-function digital inputs to "CG Offset bit1" to "CG Offset bit4" (ie: H1-03 = 69, H1-04 = 6A, H1-05 = 6B, and H1-06 = 6C). The four inputs will be used to generate a 4 bit number, 0 to 15 (see chart below). This value is then multiplied by the value in C14-04, usually 1ft. For example, an input value of 5 will add 5 * 1ft, or 5 feet to the swing length.

Value	CG Offset bit4 (6CH)	CG Offset bit3 (6BH)	CG Offset bit2 (6AH)	CG Offset bit1 (69H)
0	0	0	0	0
1	0	0	0	1
2	0	0	1	0
3	0	0	1	1
4	0	1	0	0
5	0	1	0	1
6	0	1	1	0
7	0	1	1	1
8	1	0	0	0
9	1	0	0	1
10	1	0	1	0
11	1	0	1	1
12	1	1	0	0
13	1	1	0	1
14	1	1	1	0
15	1	1	1	1

   b. CG Offset by AI – Enter the distance multiplier into C14-05. Setup an analog input to 18 – 'Cent Grav Offset.' The Analog input voltage will be multiplied by C14-05 to determine the distance from the hook to the Center of Gravity of the load. For example, if C14-05 is 2ft, and the input voltage is 2 volts, the additional length will be 2 * 2ft, or 4 feet.

The remaining setup depends on the type of drive on the hoist. For IMPULSE•VG+™ Series 3 drives, the encoder may be used to determine the hook height as a percentage of allowed travel. This percentage is then delivered via analog interconnect into the Bridge and Trolley drives and is scaled into feet to calculate the Swing Length. For non-IMPULSE•VG+™ Series 3 drives, a constant height is used when moving the load.

With IMPULSE•G+™ Series 3 Hoist Drives

The height of the hook is not known by the Hoist Drive due to lack of an encoder. There are alternative methods to determine hook height that will not be covered here. In this configuration the hook is lifted to a predetermined height before traverse movement is started. The distance from the drum to the hook at the height the load will be moved at is entered into C14-02.

1) Lift the unloaded hook to the height that will be used when moving the load.

2) Measure the distance from the drum to the hook. This value is entered into C14-02.

3) Move the Bridge and Trolley to confirm that the swing is minimized.

With IMPULSE•VG+™ Series 3 Hoist Drive

Setting up Sway Control with an IMPULSE•VG+™ Series 3 Drive on the hoist is a bit more complicated, but allows for Sway Control to function at any height, and allows lifting or lowering the load while moving. The first step is to configure the Hoist drive to output the hook height.

Setup Hoist Drive

1) Set C8-24 'Hook Height Home' to 2. A Normally Open contact on the weighted switch (UL3) is used to act as a homing location to zero out the hook height.

2) Set C8-25 'Hook Height Out' to 0. This configures the drive to output 0 volts when the hook is at UL2, and 10V when the hook is at 100% of the rope length.

3) Setup one of the available multi-function digital inputs (MFDI) to 67H = 'hook height home' (MFDI terminals S3 – S8 are set via parameters H1-01 – H1-06). This terminal should be closed when the Weighted Limit switch opens. This may require a relay as most weighted limit switches only provide normally closed contacts.

4) Set parameter C8-21 to the total number of motor revolutions available throughout the entire lift.

    a. Start by cautiously raising the hoist all the way to the weighted limit to the point where the output changes states. Ensure that this action results in the system being homed. (U1-50 will display 0%).
    b. Lower the hook all the way to the lowest point of travel (usually the floor).
    c. Transfer the number of motor revolutions from U1-51 to parameter C8-21

5) Record the motor revolutions from 'home' to the desired hook positions (UL2, UL1, LL1 and LL2). Enter the number of revolutions from U1-51 for each position in C3-12, C3-13, C3-14 and C3-15 respectively.
    a. From Weight Limit to Up Limit Stop Position – Transfer U1-51 value to C3-12
    b. From Weight Limit to Up Limit Slow Position – Transfer U1-51 to C3-13
    c. From Weight Limit to Low Limit Slow Position – Transfer U1-51 value to C3-14
    d. From Weight Limit to Low Limit Stop Position – Transfer U1-51 to C3-15

6) Use monitor parameters U1-50 and U1-51 to verify the set-up:
   U1-50 Hook Height indicates the hook height as a percentage
   U1-51 Motor Revolution indicates the motor revolutions from the home position

7) Set H4-04 to 50 'Hook Height'

8) Set H4-05 AM Gain to 100%

9) Run a shielded wire from the Analog Output AM on the Hoist Drive, to the Trolley and Bridge drives. (If the Bridge or Trolley is a multi-drive setup, run the wire to the Master drive).

The Hoist drive is now setup to output the height of the hook as an analog signal. An analog input on each of the traverse motion drives is programmed to read this value into the Sway Control function. This value will be scaled to determine the exact height of the hook. The length of the rope at 0% (UL3) and 100% (LL2) of the Hook Height needs to be determined, and entered into C14-02. There are two methods to do this, outlined below.

Finding C14-02 by manual measurement

WARNING:
Only qualified personnel using appropriate safety equipment should perform this procedure.

1) Raise the hook to just below the Upper Limit 3 position. U1-50 on the hoist drive will read 0%.

2) Measure the distance from the drum to the Hook (It may be helpful to use a long rope and mark the position with a knot or marker to be measured later). This value is the 'Const Offset,' C14-03.

3) Lower the hook to the Lower Limit 2 position. U1-50 on the hoist drive will read 100%.

4) Measure the distance from the drum to the hook.

5) Subtract the distance to Lower Limit 2 from the distance to Upper Limit 2. This is the difference in hook height when at 0% and 100%. Enter this value into C14-02.

6) Confirm that U1-62 displays the value found in step 2 when at Upper Limit 2, and the value found in step 5 when at Lower Limit 2. Ensure that the Offset by MFDI or Offset by Analog Input is zero before checking.

Finding C14-03 by swing period

1) Remove all loads from the end of the hook including slings. Lower the hook to its lowest point. U1-50 on the hoist should show 100%.

2) With Sway Control disabled, move the bridge so that the hook is swinging back and forth a few feet. The amount of swing doesn't matter, so long as it's easy to count the number of complete swings.

3) With a stop watch (or watch with a second hand), time how long 10 complete swings take. Take this number and divide by 10. This is the swing period for Lower Limit 2. Record this number.

4) Raise the hook to its highest point, U1-50 on the hoist should show 0%.

5) Move the bridge so that the hook is swinging back and forth a few feet.

6) Time how long 10 complete swings take. Take this number and divide by 10. This is the swing period for Upper Limit 3. Record this number.

7) Using the chart below, find the Swing Length for the time determined in step 6. If the recorded swing time is not shown, use the closest value. Enter this length into C14-03.

8) Using the chart below, find the Swing Length for the time determined in Step 3. Subtract the value in C14-03 from this value. Enter this value into C14-02. This is the distance in feet between Upper Limit 3 and Lower Limit 2.

Swing Time to Swing Length Conversion Table

Swing Time (Sec)	Swing Len (feet)
2.00	3
2.25	4
2.50	5
2.75	6
3.00	7
3.25	9
3.50	10
3.75	12
4.00	13
4.25	15
4.50	17
4.75	18
5.00	20
5.25	23
5.50	25
7.75	27
6.00	29
6.25	32
6.50	35

Swing Time (Sec)	Swing Len (feet)
6.75	37
7.00	40
7.25	43
7.50	46
7.75	49
8.00	52
8.25	56
8.50	59
8.75	63
9.00	66
9.25	70
9.50	74
9.75	78
10.00	82
10.25	86
10.50	90
10.75	95
11.00	99
11.25	104

9) Confirm that U1-62 displays the value found in step 7 when at Upper Limit 3, and the value found in step 8 when at Lower Limit 2. Ensure that the Offset by MFDI or Offset by Analog Input is zero before checking.

Sway Control System Limitations

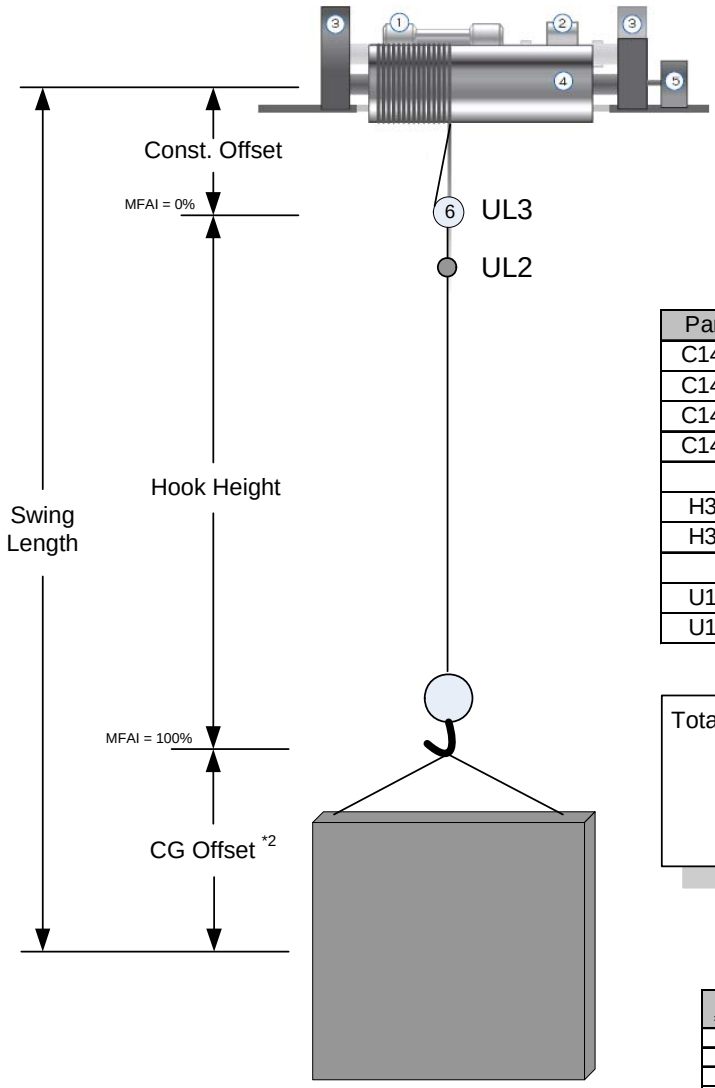
The control algorithm is built into the IMPULSE•G+™ Series 3 drive. Any installations with other drives such as an IMPULSE•G+™ Series 2 must be upgraded to Series 3 to use Sway Control. SCS-S2 is an open loop system and is only capable of not adding additional swing. It will not remove any existing swing. Also, any external forces such as wind will not be accounted for, and may cause a small amount of swing.

By default, the Sway Control System is limited to 100 feet swing lengths. The combination of all swing length adders, such as Const Offset, Offset by MFDI and so on, cannot add up to more than this value. If 100 feet is exceeded, an error will be displayed on the screen, and the crane will continue to operate using a 100 foot swing length. The parameter C14-10 allows changing the maximum swing length from 100 feet to 300 feet.

Sway Control can only be enabled or disabled by Multi Function Digital Input when the motor is not spinning. If the operator attempts to enable or disable Sway Control during a move, an error will be displayed on the operator interface indicating that switching is not currently possible. When the motor stops, the drive will immediately switch. The same limitation applies to micro speed when parameter C14-08 is set to disable Sway Control in micro speed. If during a move, micro speed is enabled, the output frequency will drop to the micro speed setting, and Sway Control will remain on. An SCS Enabled output (H2-0x = 3D) is available which can be used for a Sway Control active indicator.

Although the system is capable of running on an IMPULSE•VG+™ Series 3 drive, it is recommended to use an IMPULSE•G+™ Series 3 drive. If system requirements necessitate an IMPULSE•VG+™ Series 3 drive, please consult factory.

Hook Height Quick Reference



1. Motor / Encoder
2. Brake
3. Gear Reduction
4. Drum
5. Typical Geared Limit Switch
6. Weighted Limit Switch (Failsafe)

Param	Name	Default	Range
C14-02	Hook Height	25	0 ~ 100 ft
C14-03	Const Offset	5	0 ~ 20 ft
C14-04	CG Offset by MFDI	1	0 ~ 10 ft
C14-05	CG Offset by AI	1	0 ~ 10 ft
H3-05	Terminal A3 Sel	1F	0 ~ 1F
H3-09	Terminal A2 Sel	0	0 ~ 1F
U1-16	Terminal A2 Level	n/a	0 ~ 100%
U1-17	Terminal A3 Level	n/a	0 ~ 100%

Total Swing Length used by Sway Control System *1 =
C14-02 (multiplied by U1-17 if H3-05 = 17H)
+ C14-03
+ C14-04 (multiplied by MFDI Count, see below)
+ C14-05 (multiplied by U1-16 * 10 if H3-09 = 18H)

*1 – The total calculated Swing Length should be within 10% of the actual length for optimal results. The maximum length is 100 feet. Any total Swing Length over this will result in an SCS1 fault.

*2 – This is the distance from the hook to the Center of Gravity of the load. This distance may be set to a constant by adding additional length to the Offset (C14-03), or by using the Digital or Analog Offsets.

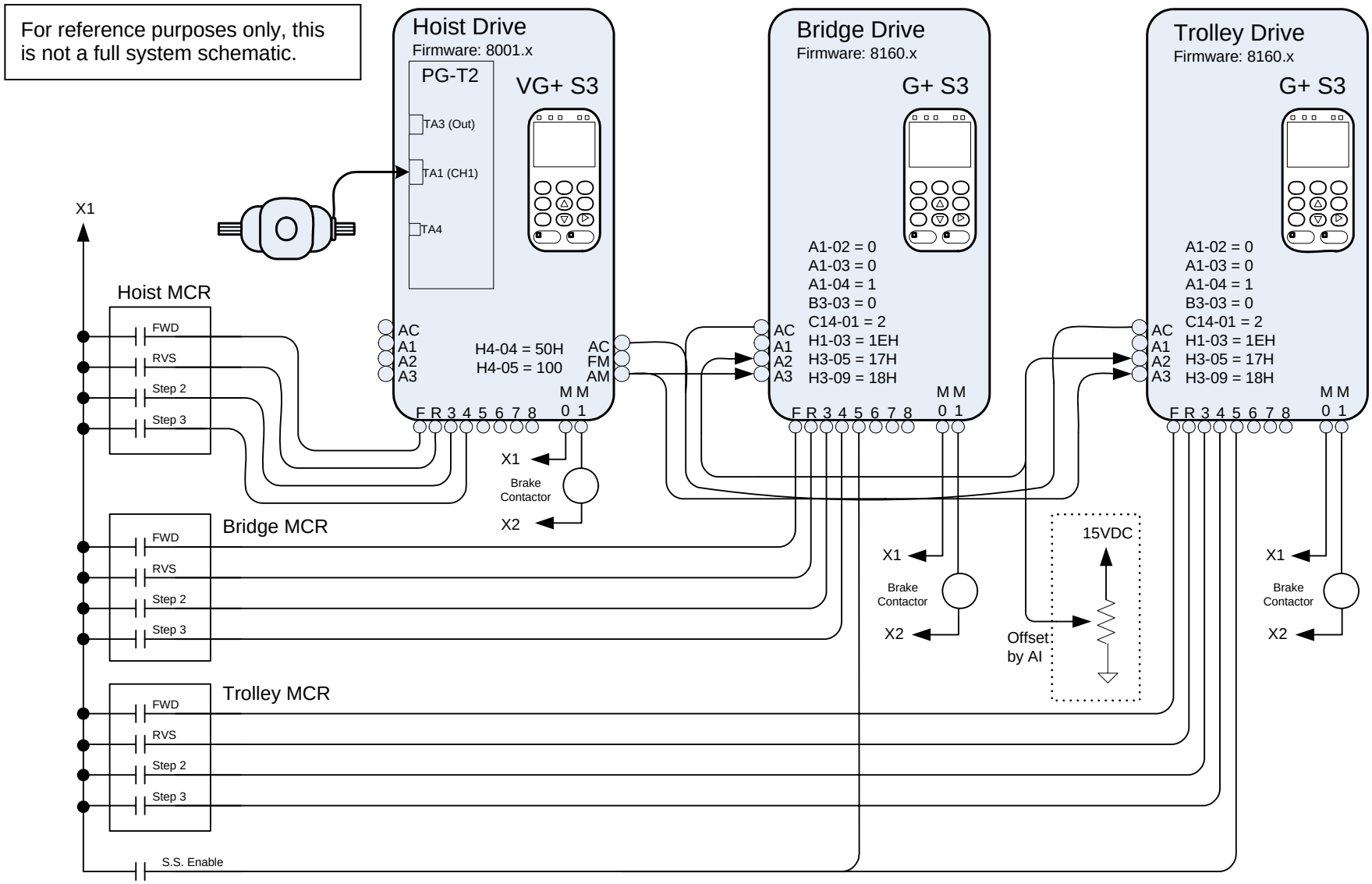
Multi Function Input Truth Table

H1-0x = 6CH	H1-0x = 6BH	H1-0x = 6AH	H1-0x = 69H	Offset by MFDI (C14-04 = 1ft)
0	0	0	0	0
0	0	0	1	1
0	0	1	0	2
0	0	1	1	3
0	1	0	0	4
0	1	0	1	5
0	1	1	0	6
0	1	1	1	7
1	0	0	0	8
1	0	0	1	9
1	0	1	0	10
1	0	1	1	11
1	1	0	0	12
1	1	0	1	13
1	1	1	0	14
1	1	1	1	15

Computed Swing Time

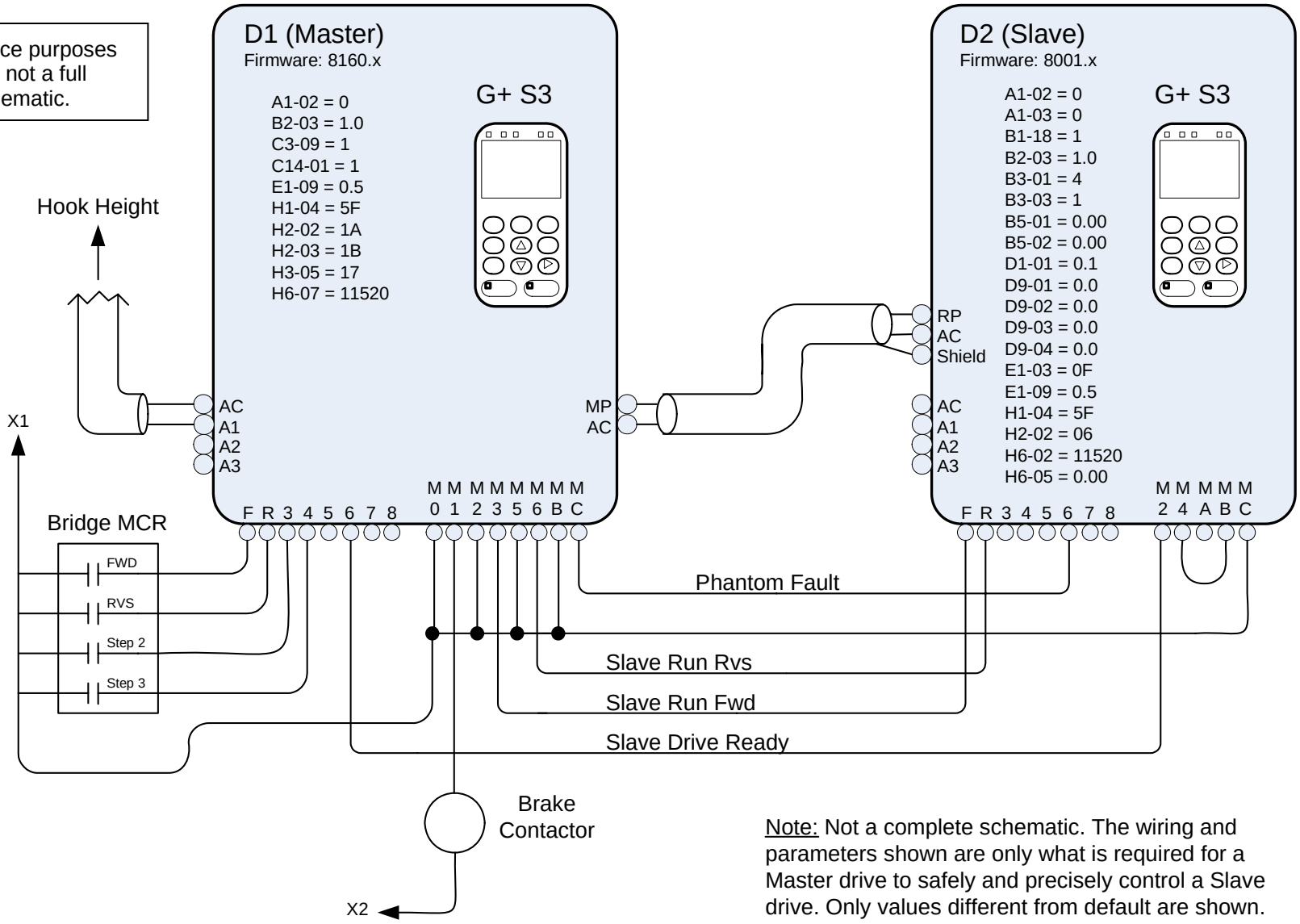
L = (t/6.25)^2 * 32	
Swing Time	Swing Len
3	7
3.5	10
4	13
4.5	16
5	21
5.5	25
6	30
6.5	34
7	40
7.5	45
8	52
8.5	59
9	66
9.5	73
10	81
10.5	89
11	98

Sample Wiring Configuration



Two Drive Master / Slave configuration

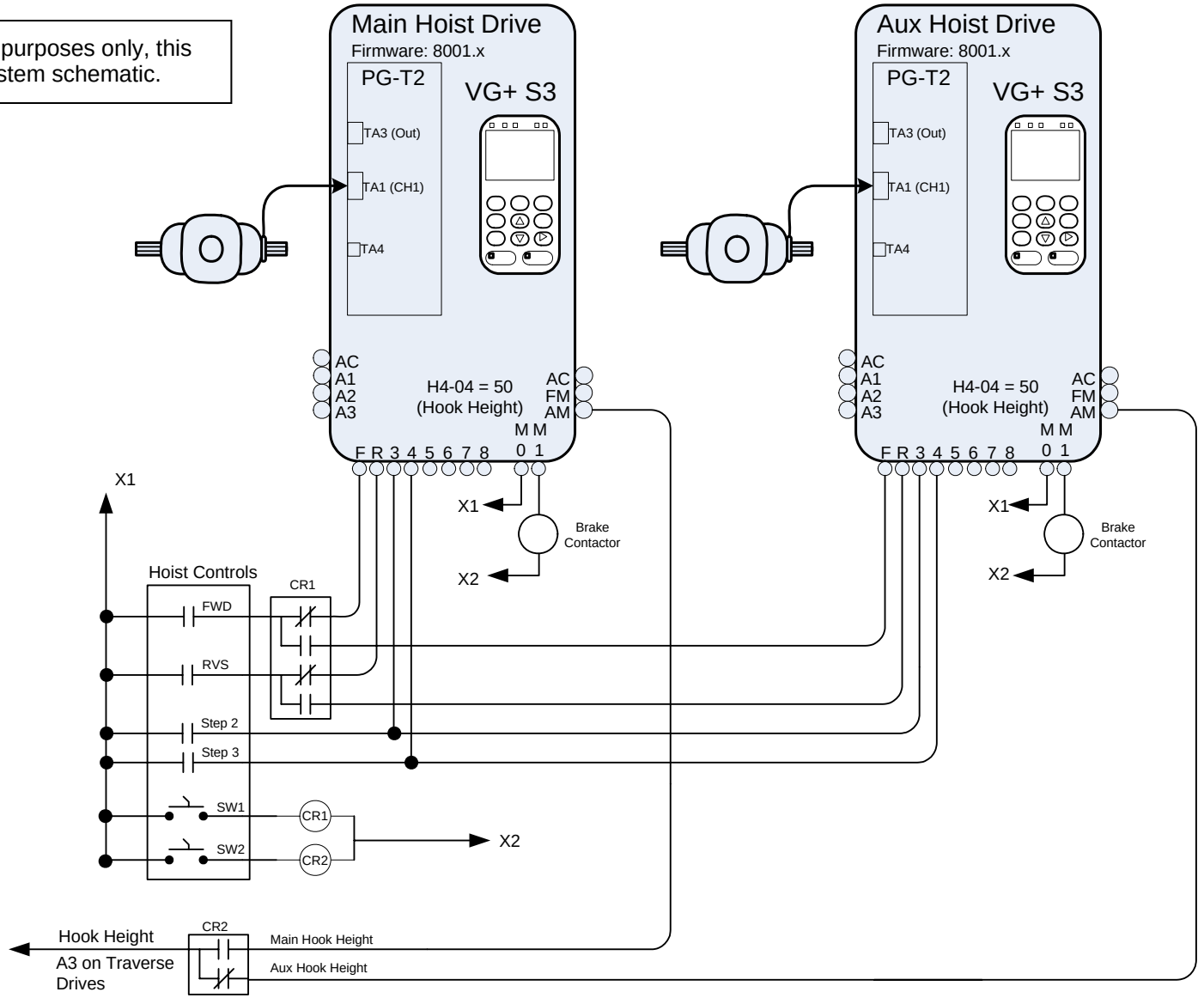
For reference purposes only, this is not a full system schematic.



Note: Not a complete schematic. The wiring and parameters shown are only what is required for a Master drive to safely and precisely control a Slave drive. Only values different from default are shown.

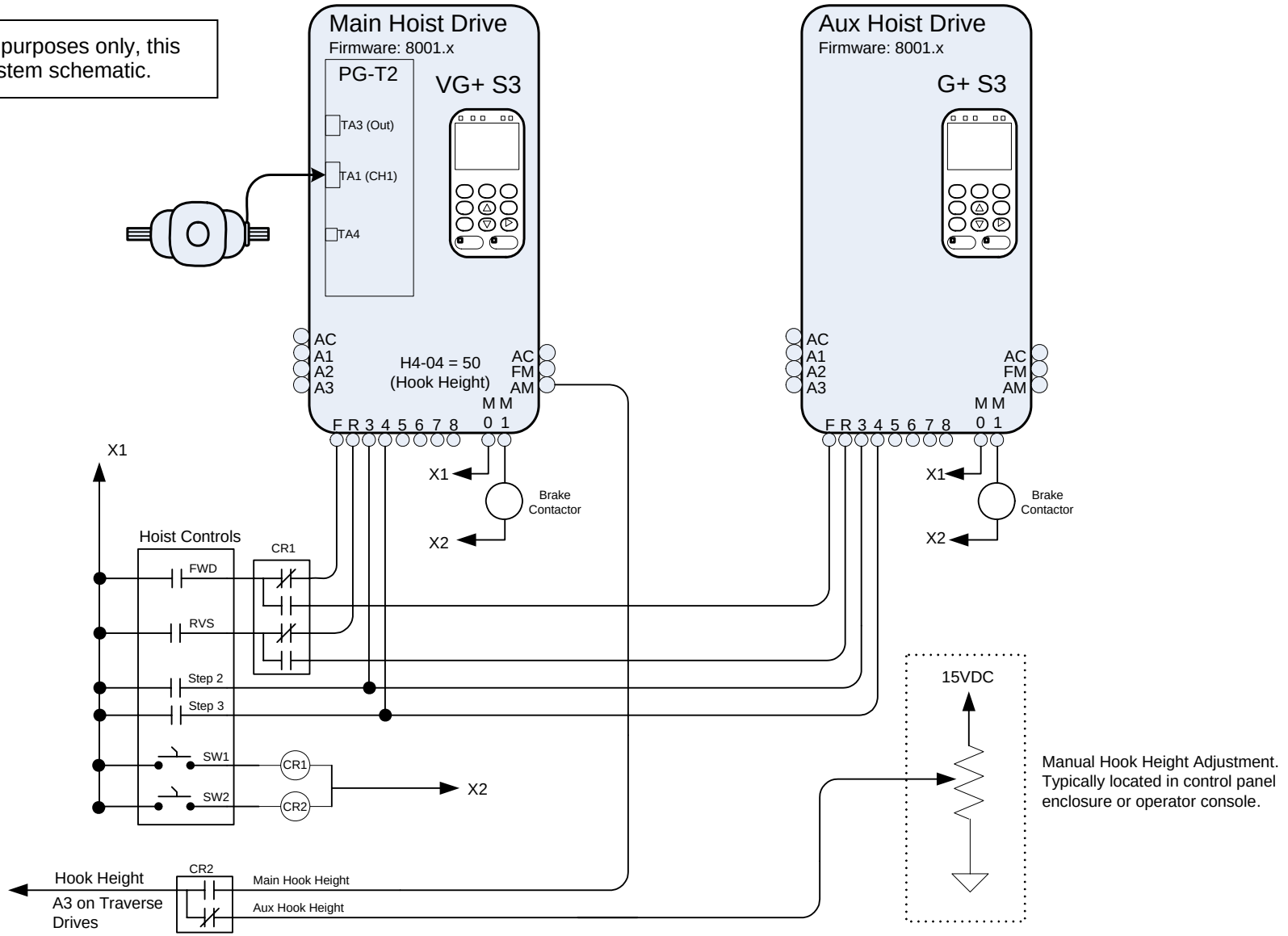
Main / Aux Hoist Configuration (VG+ S3 on Main and Aux)

For reference purposes only, this is not a full system schematic.



Main / Aux Hoist Configuration (VG+ S3 on Main, G+ S3 on Aux)

For reference purposes only, this is not a full system schematic.



Special Function Compatibility and Limitations Matrix

Special Function	Use in SCS Disabled	Use in SCS Enabled	Remark
Motion Selection: A1-03	Y	Y	Traverse motion only
Stopping Method: B3-03	Y	Y	Decel and Decel /w timer only
Accel / Decel: B5 Group MFDI 1AH, 1BH, 1CH, 40H	Y	N	See Acc/Dec priority table
Jump Frequencies: B8 Group	Y	Y	Drive may momentarily operate at a jump frequency during accel / decel
Quick Stop: C1-01, C1-02	Y	Y	See Acc/Dec priority table
Reverse Plug 0/1: C1-03 to C1-05	Y	Y	See Acc/Dec priority table
Micro Speed: C2 Gorup, MFDI EH, 10H	Y	Y	Option in C14-08 to disable Sway Control in MS
Travel Limits: C3-01 to C3-08	Y	Y	See Acc/Dec priority table
Phantom Stop Method (C3-09) in Multi Drive configuration such as A4	Y	Y	C3-09 must be set to 1
G5IN4, DI-08, DI-16: C9 Group	Y	Y	
Sway Control System: C14 Group	N	Y	Group has no function when Sway Control disabled
DC Injection Start Frequency in Multi Drive configuration as A4: D1-01	Y	Y	Slave drives must be set to 0.1
Torque Control Selection: D5 Gorup	Y	N	Torque Control method incompatible with Sway Control
S-Curve Accel / Decel: D9 Group	Y	N	S Curves disabled in Sway Control.
S-Curve Accel / Decel in Multi Drive configuration such as A4	Y	N	S Curves must be set to 0.0 in slave drives
V/f Pattern: E1 Group	Y	Y	
Fault Annunciation: FMDO 40H ~ FFH	Y	Y	
Jog Control: B1-17, MFDI 15H, 16H	Y	Y	
SCS Enabled: MFDI 1E	N	Y	Will only switch when motor is not spinning
External Fault: MFDI 20H, 21H, 22H, 23H, 28H, 29H, 2AH, 2BH	Y	N	Coast To Stop is the only allowed fault stopping method in Sway Control mode
External Fault: MFDI 24H, 25H, 26H, 27H, 2CH, 2EH, 2FH	Y	Y	
Drive Enable: MFDI 55H	Y	Y	Drive will decel to stop.
Klixon fault: MFDI 56H, 57H	Y	N	Use External Fault
Load Share: MFDI 66H	N	N	
Alt Swing Length: MFDI 6D	N	Y	Will only switch when motor is not spinning
Pulse Input / Output: H6 Group	Y	Y	
Motor Overload Protection: L1 Group	Y	Y	
PowerLoss RideTrhough: L2 Group	Y	Y	
Stall Prevention: L3 Group	Y	Y	
Speed Agree: L4 Group	Y	Y	
Under / Over Torque Detection: L6 Group	Y	Y	
Hardware Protection: L8 Group	Y	Y	
Automatic Fault Reset: L9 Group	Y	Y	

Acc / Dec priority table

Priority	Acceleration	Deceleration	Description
1	N/A	C3-03	Upper Limit 2 (Stop) Deceleration Time
2	N/A	C3-06	Lower Limit 2 (Stop) Deceleration Time
3	N/A	C3-02	Upper Limit 1 (Slowdown) Deceleration Time
4	N/A	C3-05	Lower Limit 1 (Slowdown) Deceleration Time
5	N/A	B5-08	Emergency Stop Deceleration Time
6	N/A	C1-02	Quick Stop Deceleration Time
7	C1-05	C1-04	Reverse Plug Acceleration / Deceleration Time
8	C14-06	C14-07	Sway Control Acceleration / Deceleration Time
9	B5-03	B5-04	Acceleration / Deceleration Time 2 - by MFDI 1A
10	B5-12	B5-13	Acceleration / Deceleration Time 3 - by MFDI 1B
11	B5-14	B5-15	Acceleration / Deceleration Time 4 - by MFDI 1C
12	B5-05	B5-06	Acceleration / Deceleration Changeover by Speed
13	B5-01	B5-02	Acceleration / Deceleration Time 1 (Normal)