

Tech Note #57 Rev 3

Title: S2D Drive Compatibility

Created: March 27, 2014

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ORMEC's S2D Drive series is the latest servo drive family. It adds support for Safety Interlocks, more control power voltage options, 24v I/O power output and a new power section, improving efficiencies in many cases.

The S2D drives can be used as replacements for drives of older series. This is especially useful when upgrading your system or when replacing a failed older-series drive. This Tech Note provides documentation on the compatibility issues for using an S2D replacement.

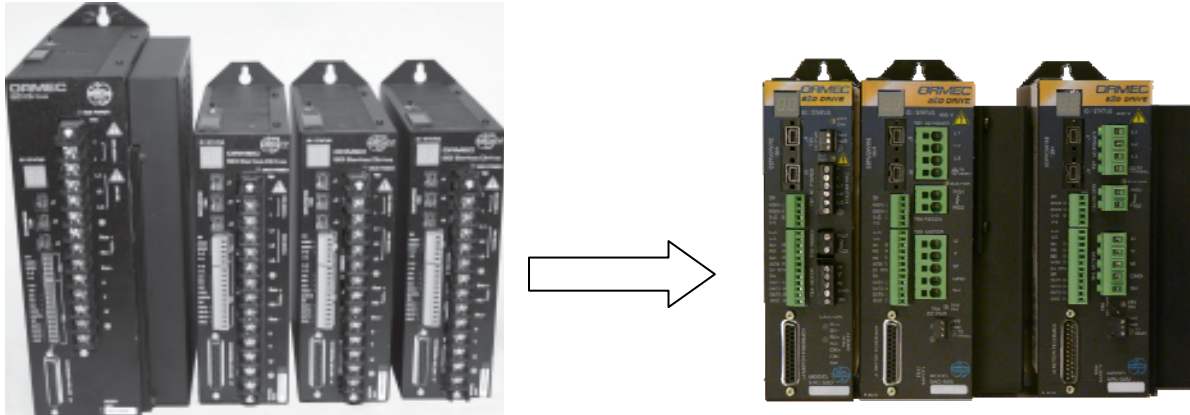
### **Drive Family Overview Comparison:**

<b>Feature</b>	<b>SW Servodrive</b>	<b>SM Servodrive</b>	<b>SD Servodrive</b>	<b>S2D Servodrive</b>
<b>1394 Comm. Speed</b>	200 Mbit/sec maximum	400 Mbit/sec maximum	1394a or 1394b with 800 Mbit/sec maximum	1394a or 1394b with 800 Mbit/sec maximum
<b>I/O Connectors</b>	Pluggable terminal block	Pluggable header	Pluggable terminal blocks	Pluggable terminal blocks
<b>Field Oriented Control</b>	No	Yes, firmware 3.0.1 or later	Yes, firmware 3.0.1 or later	Yes, firmware 3.0.1 or later
<b>High-Speed Sensors</b>	3 – ASEN, BSEN & CSEN	2 – ASEN & BSEN	2 – ASEN & BSEN	2 – ASEN & BSEN
<b>High-Speed Sensor Pull-up Resistor</b>	3 choices none (PNP), 2.38k (NPN) or 20k (NPN)	2 choices – none (PNP) or 2.7k (NPN)	2 choices – none (PNP) or 2.7k (NPN)	2 choices – none (PNP) or 2.7k (NPN)
<b>Digital I/O (optically isolated)</b>	2 Inputs, 6 Outputs	3 Inputs, 4 Outputs, 1 Bi-directional I/O.	3 Inputs, 4 Outputs, 1 Bi-directional I/O.	3 Inputs, 4 Outputs, 1 Bi-directional I/O.
<b>Brake Output</b>	OUT 6	OUT 3	OUT 3	OUT 3
<b>Drive Ready Output</b>		OUT 4	OUT 4	OUT 4
<b>Hardware Travel Limits</b>	HTLF & HTLR	IN1 & IN2	IN1 & IN2	IN1 & IN2
<b>Encoder Reference Z Output</b>	Z Out	OUT 5	OUT 5	OUT 5
<b>Delay Counter Output</b>	DELAY			OUT3
<b>Option Module Interfaces</b>	None	Support for Feedback and I/O Option Modules	Support for Feedback and I/O Option Modules	Support for Feedback and I/O Option Modules

Feature	SW Servodrive	SM Servodrive	SD Servodrive	S2D Servodrive
<b>Analog I/O</b>	2 Outputs		1 Output, 1 Input	1 Output, 1 Input
<b>ID/Status Displays</b>	2-digit seven segment display, 6 I/O status LED's and Bus Power LED	Single digit seven segment display and Bus Power LED	2-digit seven segment display, 11 I/O status LEDs and Bus Power LED	2-digit seven segment display, 11 I/O status LEDs and Bus Power LED
<b>Auxiliary Encoder Input</b>	Drive Option ( / P )	Drive Option ( -P )	Drive Option ( -P )	Drive Option ( -P )
<b>Delay Counter</b>	Drive Option ( / D )			Drive Option (-D)
<b>Yaskawa Absolute Encoder Support</b>	Drive Option ( / A )	Drive Option ( / A ) adds battery. Sigma II support always present on /S.	Drive Option ( -B ) adds battery. Sigma II support always present on -S.	Sigma II support always present on -S. Use CBL-HBAT for battery.
<b>Resolver Feedback Option</b>	None	Option Module SAC-SD-RES	Integral on -R version.	Integral on -R version.
<b>Power connections</b>	Fixed terminal block on all models.	Fixed terminal block on all models.	Fixed terminal block on all models.	Pluggable terminal blocks models 203-215, 403-405. Fixed terminal blocks all others.
<b>Control power</b>	120/230 VAC only	120/230 VAC only	120/230 VAC only	100-240 VAC or 24 VDC
<b>24 VDC output power</b>	Not available	Not available	Not available	Available when using AC control power
<b>Regen control circuitry</b>	Available on all models except 203 and 205.	Available on all models except 203 and 205.	Available on all models except 203 and 205.	Available on all models.
<b>Peak current</b>	2 times continuous rating	2 times continuous rating	2 times continuous rating	3 times continuous rating on models 203-215, 403-410. 2 times continuous rating all others.
<b>Absolute encoder battery</b>	Optional inside drive	Optional inside drive	Optional inside drive	External to drive, use cable part CBL-HBAT/n
<b>Safety circuit</b>	Not available	Not available	Not available	Available option on all models.

## SD Replacement by S2D:

The S2D line of ServoWire drives has enhanced features and functionality from the SD series of drives. Review the table found at the beginning of this document for a comparison.



In most applications the SAC-S2D series of servodrives can be used as a direct substitution for the SAC-SD drives. Considerations to review:

1. **Current capabilities.** The S2D series, models 203-215 and 403-410, have 3x peak capability versus 2x peak capability in the SD series. In all cases the S2D current capabilities are superior.

While there is an SDx220 model, there is no S2Dx220 drive. If replacing a SAC-SDx220 you will need to review your application to determine if a S2Dx215 or S2Dx225 is the correct replacement. The critical factors are the continuous and peak current requirements of the application. In most cases the S2Dx215 will be an acceptable replacement.

**Note:** Drives used with an SMLC controller will have part numbers with an M, SAC-SDM or SAC-S2DM. Drives used with an Orion Controller do not have the M in the part number, SAC-SD or SAC-S2D.

## SD Drive

## S2D Drive

Drive model	Current		Replace with	SMC Systems Current		Orion Systems Current	
	Cont	Peak		Cont	Peak	Cont	Peak
SAC-SDx203	2.4	4.8	SAC-S2Dx203	3.0	9.0	3.0	6.0
SAC-SDx205	4.2	8.4	SAC-S2Dx205	5.0	15	5.0	10
SAC-SDx210	8.4	17.2	SAC-S2Dx210	10	30	10	20
SAC-SDx217	14.2	28	SAC-S2Dx215	15	45	15	30
SAC-SDx220	17	34	SAC-S2Dx215	15	45	15	30
SAC-SDx225	25	50	SAC-S2Dx225	25	50	25	50
SAC-SDx235	35	70	SAC-S2Dx235	35	70	35	70
SAC-SDx260	60	120	SAC-S2Dx260	60	120	60	120
			SAC-S2Dx403	3.0	9.0	3.0	6.0
SAC-SDx405	5.0	10.0	SAC-S2Dx405	5.0	15.0	5.0	10.0
SAC-SDx410	10	20	SAC-S2Dx410	10	30	10	20
SAC-SDx417	17	34	SAC-S2Dx417	17	34	17	34
SAC-SDx425	25	50	SAC-S2Dx425	25	50	25	50
SAC-SDx435	35	70	SAC-S2Dx435	35	70	35	70
SAC-SDx450	50	100	SAC-S2Dx450	50	100	50	100

2. **Mounting.** The mounting hole spacings are identical in all drives except the 405 & 410. The S2D405 and S2D410 are smaller and use a different hole pattern. The S2D will mount using the same holes in all but the 2 cases above. There are minor differences in the overall width of the drives as follows:

Original model	Width	Replacement	Width
SAC-SDx203	2.6"	SAC-S2Dx203	2.2"
SAC-SDx205	2.6"	SAC-S2Dx205	2.2"
SAC-SDx210	2.6"	SAC-S2Dx210	2.73"
SAC-SDx217	3.8"	SAC-S2Dx215	4.18"
SAC-SDx220	3.9"	SAC-S2Dx215	4.18"
SAC-SDx405	4.3"	SAC-S2Dx405	3.95"
SAC-SDx410	4.3"	SAC-S2Dx410	4.18"

Note wider.

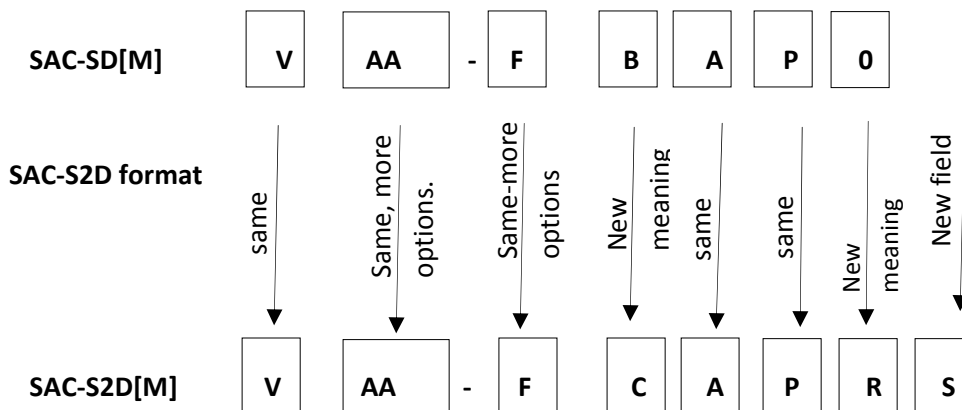
3. **Encoder cables.** No change is required. All encoder cables which plugged into a SD drive will plug into a S2D drive and work.
4. **Motor cables.** No cable change is required. All motor cables terminate in terminal blocks in SD and will in S2D. On the smaller drives, 203-215, 403-410, the terminal block changes. In most cases the change is from a single fixed terminal block to multiple pluggable terminal blocks. The wire order is the same, terminal block numbers have changed. If ring lugs were used they will need to be removed.
5. **Servowire cables:** A change may be required based on the age of the SD drive. SD drives made after May 2009 (version 1.2.0 or later) have no cable change. These drives can be identified as having 2 Servowire connectors, with locking screw support. Older models of SD drives provided 3 connectors which did not have locking screw support. With these drives the old cables will plug into the new S2D drive, however, only 2 connections are present. If your system used all 3 connections on a drive one cable will need to move to a different connection in the Servowire network. If the distance for this new link is much longer a new cable will be needed. If replacing a number of SD drives which use older cables you may want to consider replacing the old cables with new cables with locking screws. Doing so results in a more robust system connection.
6. **I/O wiring - digital:** No change is required. The I/O interface is identical.
7. **Sensor inputs:** No change is required. The high speed sensor interface is identical.
8. **I/O wiring - analog:** No change is required. The I/O interface is identical.
9. **Main (motor) power input.** No cable change is required. All main power wiring terminates in terminal blocks in SD and will in S2D. On the smaller drives, 203-215, 403-410, the terminal block changes. In most cases the change is from a single fixed terminal block to multiple pluggable terminal blocks. The order is the same, terminal block numbers have changed. If ring lugs were used they will need to be removed. On larger drives, 225 – 260, 417-450 the control power terminal block (r, t) changes style.
10. **Control power input.** No cable change is required except on 405 and 410 models. All power wiring terminates in terminal blocks in SD and will in S2D. On the smaller drives, 203-215, 403-410, the terminal block changes. In most cases the change is from a single fixed terminal block to multiple pluggable terminal blocks. The order is the same, terminal block numbers have changed. If ring lugs were used they will need to be removed. On larger drives, 225 – 260, 417-450 the control power terminal block (r, t) changes style.

On models SDx405 and SDx410 the control power changes from 115-240 VAC to 24 VDC. For these two models you will be required to supply 24 VDC control power to the drive. Current requirements are 0.5A typical, 1.7A maximum. The current requirement varies the most based on the type of motor and pacer encoders utilized. 480 VAC to 24 VDC power supplies are available, part numbers PSU-480-24-10A-D-1 or PSU-480-24-5A-D-1.

11. **Absolute encoder:** A minor change is required. The SD drive allowed an encoder backup battery to be installed. This option is not available on the S2D drive. Instead, the battery is external, provided in a CBL-HBAT/1 for H-Series motors. For other motors contact ORMEC for assistance.

12. **Regen support:** No change is required. The S2D drive has improved Regen support which will work correctly as a replacement for all SD drives. One improvement is that some models of the SD series did not support regen resistors, whereas all S2D models do.
13. **Pacer option:** There is no change in pacer cable or pacer support. All pacer encoder cables used with the SD drives will work with the S2D drives.
14. **Motors supported:** No change required. All motors supported by the SD drive are supported in the S2D drive.
15. **Status Displays:** No change. All displays and error codes in the SD are identical in the S2D. The S2D may provide new codes for expanded alarm information.
16. **Project Definition.** The project definition in ServoWire Pro or MotionDesk does not require a change. The new S2D drive will function as the old SD drive did. However, the drive will be limited to 2x peak current capability. To use the full 3x peak capability you must upgrade your ServoWire Pro to revision 3.4.0 or later and then select as S2D drive in your project. Sync the project to the SMLC to complete the upgrade. The 3x peak capability is not available in an Orion system, as 2x peak is a hard-coded limitation.
17. **Motion performance and tuning:** No change in control loop settings. Motion performance should be identical. Minor improvements may occur with later versions of S2D firmware.
18. **Firmware.** The S2D drive's firmware is different than the SD drive series. All functionality of the SD is available. This merely means that when upgrading firmware you must choose a different file.
19. **Model Numbers.** The S2D\_ drives have slightly different options than the equivalent SD\_ drive. The options are defined in the corresponding Installation and Operation manual, found at Ormec.com. The differences are noted here. Contact ORMEC for assistance.

#### SAC-SD format



#### Examples:

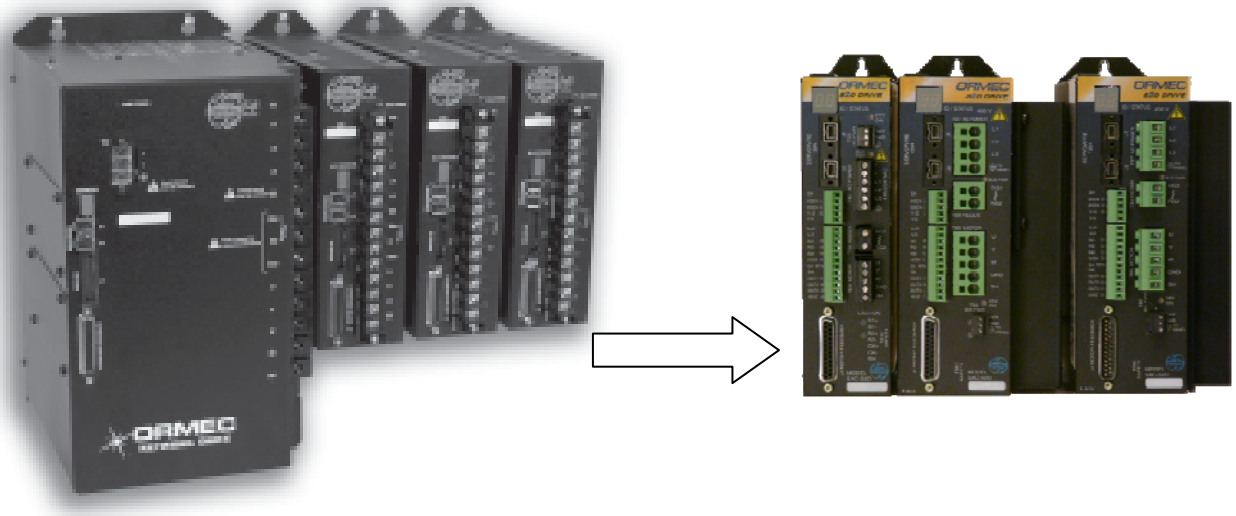
<u>Drive</u>	<u>Replaced by</u>
SAC-SD205-S0000	SAC-S2D205-SA0000
SAC-SD205-SB000	SAC-S2D205-SA0000 and CBL-HBAT/1
SAC-SDM205-S00P0	SAC-S2DM205-SA0P00

**Definition:**

- V** – voltage rating, 2 = 200v series, 4 = 400 v series. Same both models.
- AA** – Drive current rating. Same both models.
- F** – Feedback option. All options in SD in S2D. S2D adds a new option.
- B** – Battery option. Not in S2D. See Absolute encoder above.
- C** – Control voltage option. Always AC control voltage in SD. S2D can be DC. An A in this position makes the S2D same as SD. Note, A not valid on S2D403 – S2D410 models.
- A** – Analog I/O option. Same in both models.
- P** – Pacer option. Same in both models.
- R** – Regen option. New option in S2D drives. See Regen above.
- S** – Safety Interface option. New feature in S2D drive.

## SM Replacement by S2D:

The S2D line of ServoWire drives has enhanced features and functionality from the SM series of drives. Review the table found at the beginning of this document for a comparison.



In most applications the SAC-S2D series of servodrives can be used as a substitution for the SAC-SM drives. There are some issues which prevent the SD from being a direct substitution.

Considerations to review:

1. **Current capabilities.** The S2D series, models 203-215 and 403-410, have 3x peak capability versus 2x peak capability in the SM series. In all cases the S2D current capabilities are superior.

While there is an SMx220, there is no S2Dx220 drive. If replacing a SAC-SMx220 you will need to review your application to determine if an S2Dx215 or S2Dx225 is the correct replacement. The critical factors are the continuous and peak current requirements of the application. In most cases the S2Dx215 will be an acceptable replacement.

**Note:** Drives used with an SMLC controller will have part numbers with an M, SAC-SMM or SAC-S2DM. Drives used with and Orion Controller do not have the M in the part number, SAC-SM or SAC-S2D.



Drive model	SM Drive		Replace with	S2D Drive			
	Current			SMLC Systems Current		Orion Systems Current	
	Cont	Peak		Cont	Peak	Cont	Peak
SAC-SMx203	2.4	4.8	SAC-S2Dx203	3.0	9.0	3.0	6.0
SAC-SMx205	4.2	8.4	SAC-S2Dx205	5.0	15	5.0	10
SAC-SMx210	8.4	17.2	SAC-S2Dx210	10	30	10	20
SAC-SMx217	14.2	28	SAC-S2Dx215	15	45	15	30
SAC-SMx220	17	34	SAC-S2Dx215	15	45	15	30
SAC-SMx225	25	50	SAC-S2Dx225	25	50	25	50
SAC-SMx235	35	70	SAC-S2Dx235	35	70	35	70
SAC-SMx260	60	120	SAC-S2Dx260	60	120	60	120
			SAC-S2Dx403	3.0	9.0	3.0	6.0
SAC-SMx405	5.0	10.0	SAC-S2Dx405	5.0	15.0	5.0	10.0
SAC-SMx410	10	20	SAC-S2Dx410	10	30	10	20
SAC-SMx417	17	34	SAC-S2Dx417	17	34	17	34
SAC-SMx425	25	50	SAC-S2Dx425	25	50	25	50
SAC-SMx435	35	70	SAC-S2Dx435	35	70	35	70
SAC-SMx450	50	100	SAC-S2Dx450	50	100	50	100

2. **Mounting.** The mounting hole spacings are identical in all drives except the 405 & 410. The S2D405 and S2D410 are smaller and use a different hole pattern. The S2D will mount using the same holes in all but the 2 cases above. There are minor differences in the overall width of the drives as follows:

Original model	Width	Replacement	Width
SAC-SMx203	2.6"	SAC-S2Dx203	2.2"
SAC-SMx205	2.6"	SAC-S2Dx205	2.2"
SAC-SMx210	2.6"	SAC-S2Dx210	2.73"
SAC-SMx217	3.8"	SAC-S2Dx215	4.18"
SAC-SMx220	4.0"	SAC-S2Dx215	4.18"
SAC-SMx405	4.2"	SAC-S2Dx405	3.95"
SAC-SMx410	4.4"	SAC-S2Dx410	4.18"

Note wider

3. **Encoder cables.** No change is required. All encoder cables which plugged into a SM drive will plug into a S2D drive and work.

4. **Motor cables.** No cable change is required. All motor cables terminate in terminal blocks in SM and will in S2D. On the smaller drives, 203-215, 403-410, the terminal block changes. In most cases the change is from a single fixed terminal block to multiple pluggable terminal blocks. The wire order is the same, terminal block numbers have changed. If ring lugs were used they will need to be removed.
5. **Servowire cables:** A change WILL be required. The SM drives use a 1394a style connector. That connector is a different shape from the 1394b connector used on the S2D drives.

The old cable was likely a 1394a to 1394a connector with ORMEC part number CBL-SW/n. There are 2 new cables to choose from, 1394a to 1394b, ORMEC part number CBL-SW-BA-n or a 1394b to 1394b cable, ORMEC part number CBL-SW-BL.

The CBL-SW-BA-n cable would be used to go from a device with a 1394a style connector (Orion controller or SM drive for example) to the S2D drive.

The CBL-SW-BL-n cable would be used to go from a device with a 1394b style connector (SMC controller or SD or S2D drive) to the S2D drive.

Choose the correct style and number of cables for your application.

6. **I/O wiring - digital:** Changes are required if digital I/O was used.

The SM drives used a pluggable IDC crimp style header. The S2D drives use a pluggable terminal block. Electrically the digital inputs and outputs function the same. OUT3 and OUT4 have increased current sink capability which should not impact an application. Review the S2D drive output details with your specific application.

When changing the wiring from the SM to the S2D first consider the wire size. The SM header did not support large gauge wires. Is the size of the wire sufficient for the S2D terminal block? If not the wires should be replaced. If the wire size is sufficient then the crimped on pin will need to be removed from the wire and insulation stripped. Then connections should follow:

SM pin and signal, J3		S2D connector and pin	
1	ASEN	TB4	2
2	BSEN	TB4	3
3	V+S	TB4	4
4	V+S	TB5	1
5	V-S	TB4	5
6	V-S	TB5	2
7	Shield	TB4	1
8	Shield	TB5	8
9	IN1	TB5	3
10	OUT1/	TB5	9

SM pin and signal, J3		S2D connector and pin	
11	IN2	TB5	4
12	OUT2/	TB5	10
13	IN3	TB5	5
14	OUT3/	TB5	11
15	IN4/OUT 4	TB5	6
16	OUT4 RTN	TB5	7
17	Shield		8
18	OUT5/EN CZ	TB5	12
19	V+S		
20	V-S		

7. **Sensor inputs:** Changes are required in the wiring if high speed sensors are used. Functionally and electrically they are identical. However, the connector changed and therefore wiring changes are needed as defined in the previous item. It is recommended that the new sensor cable use shielded cables.

8. **I/O wiring - analog:** No change is required. The SM drive did not have analog I/O.
9. **Main (motor) power input.** No cable change is required. All main power wiring terminates in terminal blocks in SM and will in S2D. On the smaller drives, 203-215, 403-410, the terminal block changes. In most cases the change is from a single fixed terminal block to multiple pluggable terminal blocks. The order is the same, terminal block numbers have changed. If ring lugs were used they will need to be removed. On larger drives, 225 – 260, 417-450 the control power terminal block (r, t) changes style.

10. **Control power input.** No cable change is required except on 405 and 410 models. All power wiring terminates in terminal blocks in SM and will in S2D. On the smaller drives, 203-215, 403-410, the terminal block changes. In most cases the change is from a single fixed terminal block to multiple pluggable terminal blocks. The order is the same, terminal block numbers have changed. If ring lugs were used they will need to be removed. On larger drives, 225 – 260, 417-450 the control power terminal block (r, t) changes style.

On models SMx405 and SMx410 the control power changes from 115-240 VAC to 24 VDC. For these two models you will be required to supply 24 VDC control power to the drive. Current requirements are 0.5A typical, 1.7A maximum. The current requirement varies the most based on the type of motor and pacer encoders utilized. 480 VAC to 24 VDC power are available, part numbers PSU-480-24-10A-D-1 or PSU-480-24-5A-D-1.

11. **Absolute encoder:** A minor change is required. The SM drive allowed an encoder backup battery to be installed. This option is not available on the S2D drive. Instead, the battery is external, provided in a CBL-HBAT/1 for H-Series motors. For other motors contact ORMEC for assistance.
12. **Regen support:** No change is required. The S2D drive has improved Regen support which will work correctly as a replacement for all SM drives. One improvement is that some models of the SM series did not support regen resistors, whereas all S2D models do.
13. **Pacer option:** There is no change in pacer cable or pacer support. All pacer encoder cables used with the SM drives will work with the S2D drives.
14. **Motors supported:** No change required. All motors supported by the SM drive are supported in the S2D drive.
15. **Status Displays:** This has changed. The SM drives had a single digit display. Error codes would be scrolled on the display. The S2D has a 2-digit display. All error codes in the SM are identical in the S2D. The S2D may provide new codes or expanded information.
16. **Project Definition.** The project definition in ServoWire Pro for SMLC projects will require a change. Edit the project and select the new drive model number for each axis. If this is not done the SMLC will have a 1031 error when the axis is opened.

Project definition in MotionDesk for Orion systems does not require a change. The new S2D drive will function as the old SM drive did. The Orion system will allow a similarly sized drive from a different family to be used without error. However, the S2D drive will have only 2x peak current capability, matching what was available in the SM drive. The 3x peak capability of the S2D drive is not utilized in an Orion system due to hard-coded limitations.

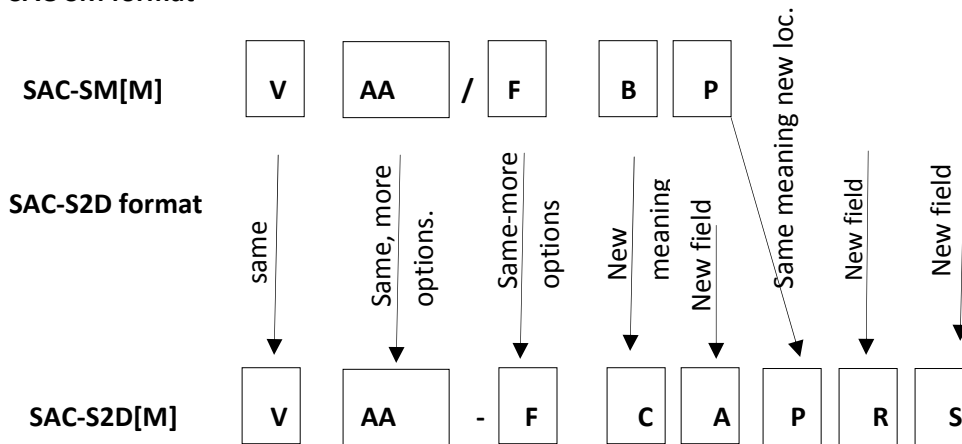
17. **Motion performance and tuning:** No change in control loop settings. Motion performance should be identical. Minor improvements may occur with later versions of S2D firmware.

18. **Firmware.** The S2D drive's firmware is different than the SM drive series. All functionality of the SM is available. This merely means that when upgrading firmware you must choose a different file.
19. **Resolver motor support:** Motors with resolver feedback can be used. There is a drive change. The SM drives used an option module to interface to the resolver. In the S2D drives no option module is needed. The feedback cable used with the SM drive can be plugged into the S2D drive without modification.

The project settings for configuration of the resolver may need to be edited. This should be reviewed for each application.

20. **Model Numbers.** The S2D\_ drives have slightly different options than the equivalent SM\_ drive. The options are defined in the corresponding Installation and Operation manual, found at Ormec.com. The differences are noted here. Contact ORMEC for assistance.

**SAC-SM format**



**Examples:**

<u>Drive</u>	<u>Replaced by</u>
SAC-SM205/E	SAC-S2D205-SA0000
SAC-SM205/S	SAC-S2D205-SA0000
SAC-SM205/SAP	SAC-S2D205-SA0P00 and CBL-HBAT/1
SAC-SMM205/SP	SAC-S2DM205-SA0P00
SAC-SMM235/SA	SAC-S2DM235-SA00R0 and CBL-HBAT/1

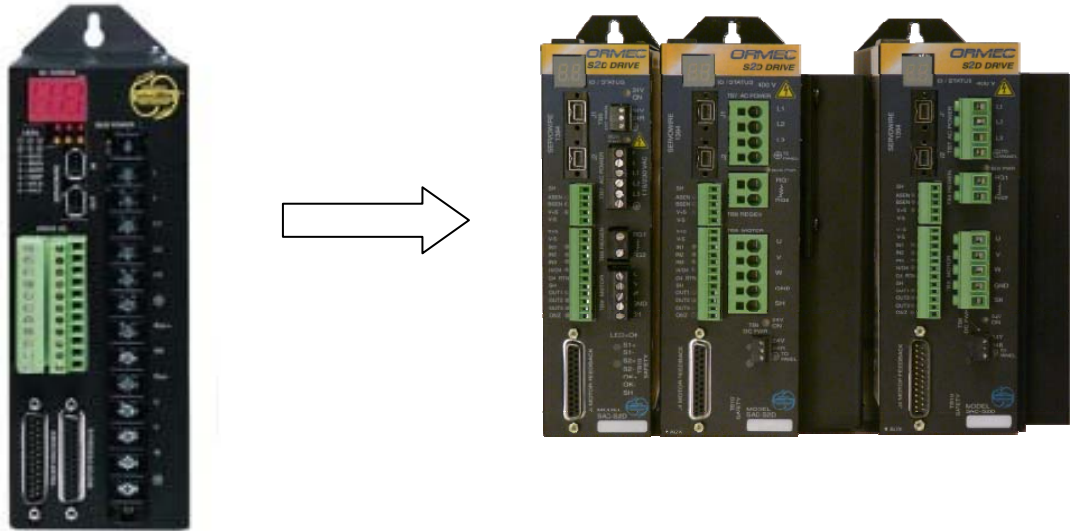
**Definition:**

- V** – voltage rating, 2 = 200v series, 4 = 400 v series. Same both models.
- AA** – Drive current rating. Same both models.
- F** – Feedback option. E or S in SM drive map to S in S2D. If resolver option module needed use R in S2D.
- B** – Battery option. Not in S2D. See Absolute encoder above.
- C** – Control voltage option. Always AC control voltage in SM. S2D can be DC. An A in this position makes the S2D same as SM. Note, A not valid on S2D403 – S2D410 models.
- A** – Analog I/O option. Same in both models.

- P** – Pacer option. Same in both models.
- R** – Regen option. New option in S2D drives. See Regen above.
- S** – Safety Interface option. New feature in S2D drive.

## SW Replacement by S2D:

The S2D line of ServoWire drives has enhanced features and functionality from the SW series of drives. Review the table found at the beginning of this document for a comparison.



In most applications the SAC-S2D series of servodrives can be used as a substitution for the SAC-SW drives. There are some issues which prevent the SD from being a direct substitution.

Considerations to review:

1. **Current capabilities.** The S2D series, models 203-215, have 3x peak capability versus 2x peak capability in the SW series. In all cases the S2D current capabilities are superior.

While there exists an SWx220 there is no S2Dx220 drive. If replacing a SAC-SWx220 you will need to review your application to determine if a S2Dx215 or S2Dx225 is the correct replacement. The critical factors are the continuous and peak current requirements of the application. In most cases the S2Dx215 will be an acceptable replacement.

**Note:** Drives used with an SMLC controller will have part numbers with an M, SAC-SWM or SAC-S2DM. Drives used with and Orion Controller do not have the M in the part number, SAC-SW or SAC-S2D.

SW Drive

S2D Drive

Drive model	Current		Replace with	SMC Systems Current		Orion Systems Current	
	Cont	Peak		Cont	Peak	Cont	Peak
SAC-SWx203	2.4	4.8	SAC-S2Dx203	3.0	9.0	3.0	6.0
SAC-SWx205	4.2	8.4	SAC-S2Dx205	5.0	15	5.0	10
SAC-SWx210	8.4	17.2	SAC-S2Dx210	10	30	10	20
SAC-SWx217	14.2	28	SAC-S2Dx215	15	45	15	30
SAC-SWx220	17	34	SAC-S2Dx215	15	45	15	30
SAC-SWx225	25	50	SAC-S2Dx225	25	50	25	50
SAC-SWx235	35	70	SAC-S2Dx235	35	70	35	70
SAC-SWx260	60	120	SAC-S2Dx260	60	120	60	120

2. **Mounting.** The mounting hole spacings are identical in all drives. The S2D will mount using the same holes. There are minor differences in the width of the drives as shown.

Original model	Width	Replacement	Width
SAC-SWx203	3.1"	SAC-S2Dx203	2.2"
SAC-SWx205	3.1"	SAC-S2Dx205	2.2"
SAC-SWx210	3.1"	SAC-S2Dx210	2.73"
SAC-SWx217	4.3"	SAC-S2Dx215	4.18"
SAC-SWx220	4.4"	SAC-S2Dx215	4.18"

3. **Encoder cables.** No change is required. All main feedback encoder cables which plugged into a SW drive will plug into a S2D drive and work.
4. **Motor cables.** No cable change is required. All motor cables terminate in terminal blocks in SW and will in S2D. On the smaller drives, 203-215, the terminal block changes. In most cases the change is from a single fixed terminal block to multiple pluggable terminal blocks. The wire order is the same, terminal block numbers have changed. If ring lugs were used they will need to be removed.
5. **Servowire cables:** A change WILL be required. The SW drives use a 1394a style connector. That connector is a different shape from the 1394b connector used on the S2D drives.

The old cable was likely a 1394a to 1394a connector with ORMEC part number CBL-SW/n. There are 2 new cables to choose from, 1394a to 1394b, ORMEC part number CBL-SW-BA-n or a 1394b to 1394b cable, ORMEC part number CBL-SW-BL.

The CBL-SW-BA-n cable would be used to go from a device with a 1394a style connector (Orion controller or SW drive for example) to the S2D drive.

The CBL-SW-BL-n cable would be used to go from a device with a 1394b style connector (SMC controller or SD or S2D drive) to the S2D drive.

Choose the correct style and number of cables for your application.

6. **I/O wiring - digital:** Changes are required if digital I/O was used.

The SW drives used a pair of pluggable terminal blocks with a total of 22 pins. The S2D drives use a trio of pluggable terminal blocks. Not all signals from the SW drives are available.

Electrically the digital inputs and outputs function the same. OUT3 and OUT4 have increased current sink capability which should not impact an application. Review the S2D drive output details with your specific application.

The most likely mapping of SW connections to S2D connections is:

SW pin and signal, TB1		S2D connector and pin	
1	AS	TB4	2
2	BS	TB4	3
3	CS		
4	SH	TB4	1
5	V+	TB4	4
6	V+	TB5	1
7	V-	TB4	5
8	V-	TB5	2
9	HTLR	TB5	4
10	HTLF	TB5	3
11	DELAY		

SW pin and signal, J3		S2D connector and pin	
12	AOUT1	TB3	2 AOUT
13	AOUT2		
14	AGND	TB3	3 AGND
15	Shield	TB5	8
16	ZOUT	TB5	12
17	OUT1/	TB5	9
18	OUT2/	TB5	10
19	OUT3/	TB5	12
20	OUT4/	TB5	6
21	OUT5/	TB5	12
22	OUT6/		

CSEN: The S2D drive has only 2 high speed sensors, not 3 as the SW drive did. If you are using CSEN then an application change will be needed when switching to an S2D drive.

HTLF/HTLR: In the SW drive these overtravel inputs were dedicated inputs. In the S2D drive IN1 and IN2 can be configured to perform the same overtravel function or used as general purpose inputs.

AOUT2: The S2D drive has only 1 analog output, as opposed to 2 of the SW drive.

Delay: This output is not available as a hardware signal in the S2D drive. In many cases the former action initiated in hardware can now be initiated in software, eliminating the need for the hardware signal. Contact ORMEC to discuss your application.

OUT1 – OUT6: The S2D drive does not offer 6 hardware outputs. However, there were limits on the outputs in the SW drives and in the S2D drives the existing outputs are more configurable. In addition PLS signals can be propagated in software, which was one of the primary uses of the outputs. Propagating in software will reduce the number of outputs needed. If your application uses 4 or fewer outputs then it is likely they can be arranged on the S2D. Project and programming changes will be required.

Use of pacer PLS signals is required. If not directed to hardware signals there usually is no problem. If the PLS was configured to be output on a drive output then changes may be needed. In the SW drive pacer PLS signals mapped to OUT4 – OUT6. In the S2D drive pacer PLS signals map to OUT4-OUT5 and there is no OUT6. If pacer PLS3 is needed to drive an



output it is possible in MotionBasic to swap the PLS output mappings so that pacer PLS go to OUT1-OUT3. Contact ORMEC if assistance is needed.

7. **Sensor inputs:** Changes are required in the wiring if high speed sensors are used. The primary issue is that the SW drive had 3 high speed sensors and the S2D has only 2. Functionally the remaining sensors are identical. There is a small electrical difference. The SW drives offered a choice of 2 pull up resistors for the NPN configuration, 2.38K or 10k ohms. The S2D offers only 1 value, 2.7k ohms. If that value will not work an external resistor will be needed.
8. **I/O wiring - analog:** A change may be needed. The SW drive provided 2 analog outputs. The S2D provides only 1. If both are needed contact ORMEC for assistance.
9. **Main (motor) power input.** No cable change is required. All main power wiring terminates in terminal blocks in SW and will in S2D. On the smaller drives, 203-215, the terminal block changes. In most cases the change is from a single fixed terminal block to multiple pluggable terminal blocks. The order is the same, terminal block numbers have changed. If ring lugs were used they will need to be removed. On larger drives, 225 – 260, the control power terminal block (r, t) changes style.
10. **Control power input.** No cable change is required. All power wiring terminates in terminal blocks in SW and will in S2D. On the smaller drives, 203-215, the terminal block changes. In most cases the change is from a single fixed terminal block to multiple pluggable terminal blocks. The order is the same, terminal block numbers have changed. If ring lugs were used they will need to be removed. On larger drives, 225 – 260, the control power terminal block (r, t) changes style.
11. **Absolute encoder:** A minor change is required. The SW drive allowed an encoder backup battery to be installed. This option is not available on the S2D drive. Instead, the battery is external, provided in a CBL-HBAT/1 for H-Series motors. For other motors contact ORMEC for assistance.
12. **Regen support:** No change is required. The S2D drive has improved Regen support which will work correctly as a replacement for all SM drives. One improvement is that some models of the SW series did not support regen resistors, all S2D models do.
13. **Pacer option:** There is no change in pacer cable or pacer support. All pacer encoder cables used with the SW drives will work with the S2D drives.
14. **Motors supported:** Possible compatibility issue. The SW drive supported an absolute encoder version of the MAC-DE, MAC-DA, MAC-DB motor series. The S2D supports only the incremental encoder versions and does not support the absolute encoder version of these motors. Motor models with a /I are incremental and /A are absolute.
15. **Status Displays:** This has minimal changes. Both drives have 2-digit displays. The information is essentially the same though some status patterns may be slightly different. All error codes in the SW are identical in the S2D. The S2D may provide new codes or expanded information. There are differences in the status LEDs. Review the installation manuals for further details.
16. **Project Definition.** The project definition in ServoWire Pro for SMLC projects will require a change. Edit the project and select the new drive model number for each axis. If this is not done the SMLC will have a 1031 error when the axis is opened.

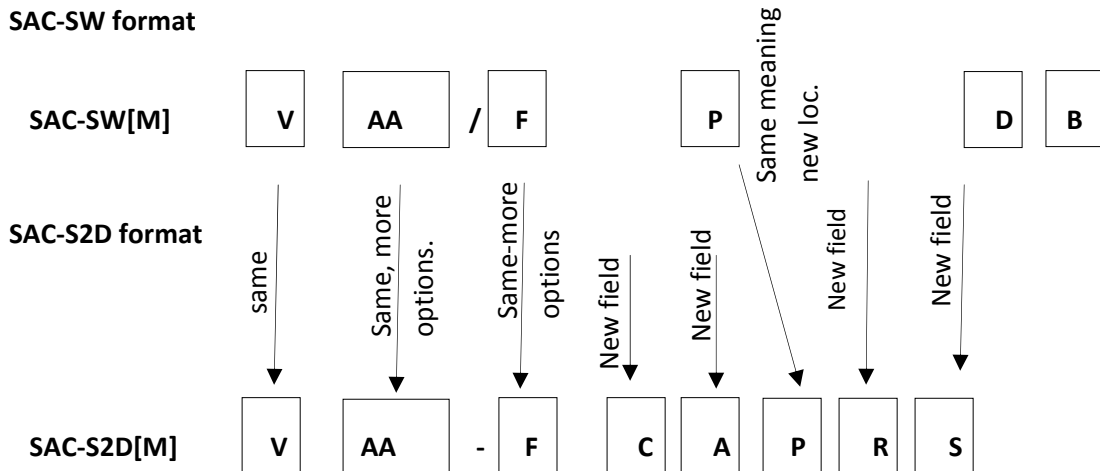
Compatibility issue: A ServoWire Pro configuration for an SMLC project cannot mix SWM drives with S2DM drives (or any other type). If the project has more than one SWM drive then all drives will need to be changed.

Project definition in MotionDesk for Orion systems does not require a change. The new S2D drive will function as the old SW drive did. The Orion system will allow a similarly sized drive from a different family to be used without error. However, the S2D drive will have only 2x peak current capability, matching what was available in the SM drive. The 3x peak capability of the S2D drive is not utilized in an Orion system due to hard-coded limitations.

In Orion based systems S2D drives can be mixed with SW drives. Unlike an SMLC based system a single SW drive can be changed to an S2D drive.

17. **Motion performance and tuning:** No change in control loop settings. Motion performance should be identical. Minor improvements may occur with later versions of S2D firmware.
18. **Firmware.** The S2D drive’s firmware is different than the SW drive series. All functionality of the SW is available. This merely means that when upgrading firmware you must choose a different file.
19. **Resolver motor support:** This is not an issue. The SW drives did not support motors with resolver feedback.
20. **Model Numbers.** The S2D\_ drives have slightly different options than the equivalent SW\_ drive. The options are defined in the corresponding Installation and Operation manual, found at Ormec.com. The differences are noted here. Contact ORMEC for assistance.

**SAC-SW format**



**Examples:**

<u>Drive</u>	<u>Replaced by</u>
SAC-SW205/E	SAC-S2D205-SA0000
SAC-SW205/EP	SAC-S2D205-SA0P00
SAC-SW217/EA	SAC-S2D215-SA00R0 and CBL-HBAT/1
SAC-SWM205/E	SAC-S2DM205-SA0000
SAC-SWM235/EPA	SAC-S2DM235-SA0PR0 and CBL-HBAT/1

**Definition:**

- V** – voltage rating, 2 = 200v series, 4 = 400 v series. Same both models.
- AA** – Drive current rating. Same both models.
- F** – Feedback option. E in SW drive map to S in S2D.
- B** – Battery option. Not in S2D. See Absolute encoder above.
- C** – Control voltage option. Always AC control voltage in SW. S2D can be DC. An A in this position makes the S2D same as SW. Note, A not valid on S2D403 – S2D410 models.
- A** – Analog I/O option. New feature in S2D.
- D** – Delay counter option. Use feedback option D.
- P** – Pacer option. Same in both models.
- R** – Regen option. New option in S2D drives. See Regen above.
- S** – Safety Interface option. New feature in S2D drive.