

Application Note

Comparison of Yaskawa DeviceNet Solutions

Applicable Products

Drives: F7, G7, P7, V7, V7N, G5, G5HHP, P5, V1000

Option Kits: CM012, CM013, CM052, CM053, CM054,
CM055, CM056, CM057, CM058, CM059, V7N, SI-N3/V

Application Note

Subject: Application Note	Product: DeviceNet	Doc#: AN.AFD.14
Title: Comparison of Yaskawa DeviceNet Solutions		

INTRODUCTION

The following document compares the various DeviceNet offerings for Yaskawa 7 Series drives (F7, G7, P7, and V7). Yaskawa has released many DeviceNet solutions over the last 10 years and there is no easy rule as to which kit to use. Many have overlapping features but none are completely interchangeable (plug and play). This document attempts to summarize what each kit's features are to aid in choosing a kit for a new installation or replacing/ adding a kit in the field.

INTENDED AUDIENCE

This document assumes that the reader is familiar with Yaskawa 7 Series AC Drives, DeviceNet and DeviceNet technical terminology and operation, and is also familiar with DeviceNet networking utility tools.

OVERVIEW

The tables on the following pages attempt to summarize each kit's feature set including supported input and output instances, ADR support (automatic device replacement), auto-baud rate detection, etc. There are also tables which give additional details on the various DeviceNet instances.

In general, follow the guidelines listed below:

New Installations

New installations without any requirements of backwards compatibility should use the V7N drive, the CM012 kit for F7, G7, P7, G5, G5HHP, the SI-N3/V for the V1000, or the CM013 for the V7.

Existing Installations

When replacing a failed card in the field or adding an additional drive to an existing network, it is generally recommended to use the existing kit found in the installation. This will ease in the support of the network.

Note: Each DeviceNet kit has unique EDS (electronic data sheets) files for each model of every drive series. These can be found on www.yaskawa.com. If you choose to replace an existing kit with a different kit, you must use the new EDS file as well.

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DeviceNet Option Matrix

Option	Option PCB Part #	Supported Products (EDS Files Available)						Supported Instances		Notable Characteristics				Applicable Manuals		
		VI1000	G7	F7	P7	V7	G5	G5HHP	P5	Output (PLC -> Drive)	Input (Drive -> PLC)	Removable Terminal Block	Option Port 3CN Accessible	ADR (Automatic Device Recovery)	Auto Baud Rate Detection	Technical Manual
CM052	SI-N1V					Y			20, 21, 100, 101	70, 71, 150, 151	N	n/a	N	N	TM4320	IG.V7.13
CM053	46S03318-001X UTC000058						Y	Y	20, 21, 22, 23, 120, 121, 122, 123, 124, 125, 126	70, 71, 72, 73, 130, 131, 132, 134, 135, 136	Y	N	N	N	TM 4556	IG.AFD.14
CM054	WRC Gateway 1782-JDM-1 RS232						Y	Y	(Modbus RTU format)	(Modbus RTU format)	n/a	n/a	N	N	TM 4026	2Y25-0537
CM055	WRC Gateway 1782-JDM-2 RS485		Y	Y	Y	Y	Y	Y	(Modbus RTU format)	(Modbus RTU format)	n/a	n/a	N	N	TM 4026	2Y25-0537
CM056	46S03318-002X UTC000059			Y					20, 21, 22, 23, 120, 121, 122, 123, 124, 125, 126	70, 71, 72, 73, 130, 131, 132, 134, 135, 136	Y	N	N	N	TM.AFD.14	IG.AFD.14
CM057	46S03318-003X UTC000060		Y						20, 21, 22, 23, 120, 121, 122, 123, 124, 125, 126	70, 71, 72, 73, 130, 131, 132, 134, 135, 136	Y	N	N	N	TM.AFD.14	IG.AFD.14
CM058	46S03318-004X UTC000061				Y				20, 21, 22, 23, 120, 121, 122, 123, 124, 125, 126	70, 71, 72, 73, 130, 131, 132, 134, 135, 136	Y	N	N	N	TM.AFD.14	IG.AFD.14
CM059	SI-N1		Y	Y			Y	Y	20, 21, 100, 101	70, 71, 150, 151	N	Y	N	N	TM.AFD.13	IG.AFD.13
CM012	UTC000180		Y	Y	Y		Y (rev F)	Y	20, 21, 22, 23, 100, 101, 102, 105, 107	70, 71, 72, 73, 150, 151, 152, 155, 157	Y	Y	Y	Y	TM.AFD.16	IG.AFD.16
CM013	UTC000180					Y			20, 21, 22, 23, 100, 101, 102, 105, 107	70, 71, 72, 73, 150, 151, 152, 155, 157	Y	Y	Y	Y	TM.V7.16	IG.V7.16
V7N	V7NU								20, 21, 100, 101, 102, 105, 106	70, 71, 150, 151, 152, 155, 156	Y	n/a	Y*	Y*	TM.V7N.01	IG.V7N.01
SI-N3V	UTC000290	Y							20, 21, 22, 23, 100, 101, 102, 105, 106, 107, 108, 120, 121, 122, 123, 124, 125, 126	70, 71, 72, 73, 150, 151, 152, 155, 156, 157, 158, 130, 131, 132, 134, 135, 136	Y	n/a	Y	Y		

* Note: Only available in software version 0014 or later.

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Instance Details

Input	Description	Message Packet # Bytes	Running	FWD Run	REV Run	Fault Reset	External Fault (EFO)	Net Reference	Net Control	Digital Input Terminal Control (S3-S8) *	Digital Input Terminal Control (S9-S12) *	Digital Output Terminal Control (M1,M3,M5) **	Digital Output Terminal Control (P3,P4) **	Analog Output Terminal Control	Speed Reference	Torque Reference	Torque Compensation	Drive Ready	Alarm	Speed Agree	Fault Reset	Zero Speed	Local Control	Undervoltage	OPE Error	Zero Servo Complete	Power Loss Ridethru Active	Modbus Message	Service Code/Class/Attribute Access	Acceleration Time	Deceleration Time	Notes		
20(14h)	Basic Speed Control	4		X		X									X																	(Speed Ref in RPM for CM053,CM056,CM057,CM058), (Speed Ref scaled by 0.1-0.3 in CM012), (Speed Ref in RPM w/ Speed Scale in CM059), (Speed Ref scaled by n035 in V7N)		
21(15h)	Extended Speed Control	4		X		X		X							X																	NetRef and NetCtrl not available in CM053		
22(16h)	Basic Speed and Torque Control	6		X		X									X	X																(Torque Reference in N-m for CM053,CM056,CM057,CM058), (Torque Reference in % for CM012, CM059)		
23(17h)	Extended Speed and Torque Control	6		X		X		X							X	X																NetRef and NetCtrl not available in CM053		
100(64h)	Modbus Message (Yaskawa Specific)	5																														(Supports function code 03(Multiple Register Read) and 10(Multiple Register Write))		
101(65h)	Standard Control - DI/DO w/Torque Reference (Yaskawa Specific)	8		X		X		X		X	X				X	X	X															(Torque Ref and Torque Compensation not available with V7N)		
102(66h)		8		X		X		X		X	X				X																			
105(69h)	Enhanced Control - DI/DO w/ Modbus (Yaskawa Specific)	8		X		X		X		X	X				X																			
106(6Ah)	General Purpose DI/DO (Yaskawa Specific)	8		X		X		X		X	X				X																			
107(6Bh)	Standard - DI/DO Control (Yaskawa Specific)	8		X		X		X		X	X				X																			
108(6Ch)	Enhanced Control Dynamic (Yaskawa Specific)	8		X		X		X		X	X				X																		SI-N3 V only	
120(78h)	Speed Command 1 (Yaskawa Specific)	4		X		X		X		X	X				X																		Speed Ref in Hz x 100 (CM053,CM056,CM057,CM058)	
121(79h)	Torque Command 1 (Yaskawa Specific)	4		X		X		X		X	X				X																		Torque Ref in % x100(CM053,CM056,CM057,CM058)	

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Instance Details (Continued)

Input	Description	Message Packet # Bytes	Running	FWD Run	REV Run	Fault Reset	External Fault (EFO)	Net Reference	Net Control	Digital Input Terminal Control (S3-S8) *	Digital Input Terminal Control (S9-S12) *	Digital Output Terminal Control (M1,M3,M5) **	Digital Output Terminal Control (P3,P4) **	Analog Output Terminal Control	Speed Reference	Torque Reference	Torque Compensation	Drive Ready	Alarm	Speed Agree	Fault Reset	Zero Speed	Local Control	Undervoltage	OPE Error	Zero Servo Complete	Power Loss Ridethru Active	Modbus Message	Service Code/Class/Attribute Access	Acceleration Time	Deceleration Time	Notes	
122(7Ah)	Speed Command 2 (Yaskawa Specific)	6		X	X	X	X	X	X	X					X																		
123(7Bh)	Torque Command 2 (Yaskawa Specific)	6		X	X	X	X	X	X	X						X																	
124(7Ch)	Speed Command 3 (Yaskawa Specific)	8		X	X											X																	
125(7Dh)	Torque Command 3 (Yaskawa Specific)	8		X	X											X																	
126(7Eh)	Speed and Torque Command 1 (Yaskawa Specific)	8		X						X					X		X																

* Note: Input Terminal Support: P7 terminals S1 to S7, F7 terminals S1 to S8, G7 terminals S1 to S12, V7N terminals S1 to S7 (S5, S6, S7 available only via DN).
 ** Note: Output Terminal Support: P7 terminals M1 and M3, F7 terminals M1, M3, M5, G7 terminals M1, M3, M5, P3, P4, V7N terminals P1, P2, MA (MA via DN only).

Application Note

Instance Details (Continued)

Output	Description	# Bytes	Running	Running FWD	Running REV	Fault	Alarm	Net Reference	Net Control	Drive State	Digital Input Terminal Status (S3-S8)	Digital Input Status (S9-S12)	Digital Output Terminal Status (M1,M3,M5)	Digital Output Terminal Status (P3,P4)	Analog Input Monitor	Motor Speed	Motor Torque	Speed Reference	Drive Ready	Motor Selection	Speed Agree	Fault Reset Active	Zero Speed	Local/Remote Indication	During Ridethru	OPE Error	Zero Servo Complete	Modbus Message	Motor Current	Undervoltage	Service Code/Class/Attribute Access	Notes		
70(48h)	Basic Speed Status	4	X			X									X																	(Motor Speed in RPM for CM056,CM057,CM058). (Motor Speed as scaled by 01-03 for CM012). (Motor Speed in RPM w/ Speed Scale in CM059)		
71(47h)	Extended Speed Status	4		X	X	X	X	X	X						X			X		X												(Drive State applies to CM056,CM057,CM058 only) NetRef and NetCtrl not available in CM053		
72(48h)	Basic Speed and Torque Status	6		X		X									X	X																(Motor Torque in N-m for CM056,CM057,CM058). (Motor Torque in % for CM012)		
73(49h)	Extended Speed and Torque Status	6		X	X	X	X	X	X						X	X																(Drive State applies to CM056,CM057,CM058 only) NetRef and NetCtrl not available in CM053		
130(82h)	Speed Status 1 (Yaskawa Specific)	4	X			X	X						X		X																	Motor Speed in Hz x 100 (CM056,CM057,CM058)		
131(83h)	Current Status 1 (Yaskawa Specific)	4	X			X	X						X		X																	Motor Current in Amps (CM056,CM057,CM058)		
132(84h)	Speed and Current Status 1 (Yaskawa Specific)	6	X			X	X						X		X																			
134(86h)	Speed Status 2 (Yaskawa Specific)	8	X			X	X								X																			
135(87h)	Current Status 2 (Yaskawa Specific)	8	X			X	X												X															
136(88h)	Speed and Torque Status (Yaskawa Specific)	8	X			X	X						X																					Speed Ref in Hz x 100 (CM056,CM057,CM058)

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Instance Details (Continued)

Output	Description	# Bytes	Running	Running FWD	Running REV	Fault	Alarm	Net Reference	Net Control	Drive State	Digital Input Terminal Status (S3-S8)	Digital Input Status (S9-S12)	Digital Output Terminal Status (M1,M3,M5)	Digital Output Terminal Status (P3,P4)	Analog Input Monitor	Motor Speed	Motor Torque	Speed Reference	Drive Ready	Motor Selection	Speed Agree	Fault Reset Active	Zero Speed	Local/Remote Indication	During Ridethru	OPE Error	Zero Servo Complete	Modbus Message	Motor Current	Undervoltage	Service Code/Class/Attribute Access	Notes
150(96h)	Modbus Message (Yaskawa Specific)	5																													(Supports function code 03(Multiple Register Read) and 10(Multiple Register Write))	
151(97h)	Standard Control - Drive Status w/ Fout, Iout, Tref (Yaskawa Specific)	8	X		X	X	X						X			X			X		X	X	X		X			X	X		Motor Torque and During Ridethru not available in CM059), (During UV not available with CM012)	
152(98h)	Accel/Decel Time Control (Yaskawa Specific)	8	X		X	X	X						X			X		X		X	X	X	X		X				X			
155(9Bh)	Enhanced Control - Drive status w/ Modbus (Yaskawa Specific)	8	X		X	X	X						X			X			X		X	X	X		X			X	X			
156(9Ch)	General Purpose DI/DO (Yaskawa Specific)	8	X		X	X	X						X			X			X		X	X	X					X	X			
157(9Dh)	Standard - DI/DO Control (Yaskawa Specific)	8	X		X	X	X						X			X			X		X	X	X		X			X	X			
158(9Eh)	Enhanced Control Dynamic (Yaskawa Specific)	8	X		X	X	X									X			X		X	X	X		X			X	X		SI-N3/V only	
199(C7h)	COS	8	X		X	X	X									X			X		X	X	X		X			X	X		SI-N3/V only	

Note 1: This description applies to the CM059 and CM012 options.
 Note 2: This description applies to the CM056, CM057, and CM058 options.

100(64h) - Note 2 Command Object (Yaskawa Specific)
 101(65h) - Note 2 Status Object (Yaskawa Specific)
 102(66h) - Note 2
 103(67h) - Note 2
 104(67h) - Note 2

Application Note

Instance Table

Output	Description
20(14h)	This assembly provides: run forward, fault reset, and speed reference as scaled by O1-03 (Rpm only for CM056,CM057, CM058).
21(15h)	This assembly provides: run forward, run reverse, fault reset, network control enable, network reference enable, and speed reference as scaled by O1-03 (Rpm only for CM056,CM057, CM058).
22(16h)	This assembly provides: run forward, fault reset, speed reference as scaled by O1-03, and torque reference in %.
23(17h)	This assembly provides: run forward, run reverse, fault reset, network control enable, network reference enable, speed reference as scaled by O1-03, and torque reference in %.
100(64h)	This assembly allows all drive parameters and monitors to be read/set through access of Modbus registers.
101(65h)	This assembly provides: run forward, run reverse, digital input terminals (S1-S8), digital output terminals (M1, M3, M5), speed reference as scaled via O1-03, torque reference in % of rated torque, and torque compensation in % of rated torque.
102(66h)	This assembly provides: run forward, run reverse, fault, fault reset, digital input terminals (S3-S8), digital output terminals (M1, M3, M5), speed reference, Acceleration and deceleration times.
105(69h)	This assembly provides: external fault, fault reset, control of digital input terminals (S1-S8), digital output terminals (M1, M3, M5), speed reference as scaled via O1-03, function bits (supports modbus register read/write).
106(6Ah)	This assembly provides: run forward, run reverse, fault, fault reset, digital input terminals (S3-S8), digital output terminals (M1, M3, M5), speed reference.
107(6Bh)	This assembly provides: external fault, fault reset, control of digital input terminals (S1-S12), digital output terminals (M1, M3, M5, P3, P4), speed reference as scaled via O1-03, control of analog output (terminal FM/21).
108(6Ch)	This assembly provides: run forward, run reverse, fault, fault reset, digital input terminals (S3-S8), digital output terminals (M1, M3, M5), torque reference and Memobus parameter access.
120(78h)	Assembly provides: run forward, run reverse, multi-function inputs, external fault, fault reset, and speed reference in Hz.
121(79h)	This assembly provides: run forward, run reverse, multifunction inputs, external fault, fault reset, and torque reference in % of rated torque.
122(7Ah)	This assembly provides: run forward, run reverse, multifunction inputs, external fault, fault reset, and torque reference in % of rated torque, Hz, network reference selection, and network control.
123(7Bh)	This assembly provides: run forward, run reverse, multifunction inputs, external fault, fault reset, torque reference in % of rated torque, network reference selection, and network control selection.
124(7Ch)	This assembly provides: run forward, run reverse, multifunction inputs, speed reference in Hz, and access to Drive parameters.
125(7Dh)	This assembly provides: run forward, run reverse, multifunction inputs, and torque reference in % of rated torque, and access to Drive parameters.
126(7Eh)	This assembly provides: run forward, run reverse, multifunction inputs, speed reference in Hz, torque reference in % of rated torque, and torque compensation in % of rated torque.

Application Note

Instance Table (Continued)

Input	Description
70(46h)	This assembly provides: Drive fault, running forward, and output speed as scaled by O1-03.
71(47h)	This assembly provides: Drive fault, Drive alarm, running forward, running reverse, Drive ready, network control enabled, network reference enabled, speed agree, and output speed as scaled by O1-03.
72(48h)	This assembly provides: Drive fault, running forward, output speed as scaled by O1-03, and output torque in %.
73(49h)	This assembly provides: Drive fault, Drive alarm, running forward, running reverse, Drive ready, network control enabled, network reference enabled, at speed, Drive state, output speed as scaled by O1-03, and output torque in %.
130(82h)	This assembly provides: running, at zero speed, Drive reversing, fault reset, at speed, Drive ready, Drive alarm, Drive fault, during ride-thru, local/remote, motor selection, zero servo complete, and output speed in Hz.
131(83h)	This assembly provides: running, at zero speed, Drive reversing, fault reset, at speed, Drive ready, Drive alarm, Drive fault, during ride-thru, local/remote, motor selection, zero servo complete, and output current in Amps.
132(84h)	This assembly provides: running, at zero speed, Drive reversing, fault reset, at speed, Drive ready, Drive alarm, Drive fault, during ride-thru, local/remote, motor selection, zero servo complete, output current in Amps, and output speed in Hz.
134(86h)	This assembly provides: running, at zero speed, Drive reversing, fault reset, at speed, Drive ready, Drive alarm, Drive fault, motor speed in Hz, and access to Drive parameters.
135(87h)	Assembly provides: running, at zero speed, Drive reversing, fault reset, at speed, Drive ready, Drive alarm, Drive fault, output torque in % of rated torque, and access to Drive parameters.
136(88h)	This assembly provides: running, at zero speed, Drive reversing, fault reset, at speed, Drive ready, Drive alarm, Drive fault, output torque in % of rated torque, motor speed in Hz, and frequency reference in Hz.
150(96h)	This assembly allows all drive parameters and monitors to be read/set through access of Modbus registers.
151(97h)	This assembly provides: running, at zero speed, Drive reversing, fault reset, at speed, Drive ready, Drive alarm, Drive fault, during ride-thru, OPE error, local/remote, zero servo complete, digital output terminal status (M1, M3, M5), output current in Amps, output frequency as scaled by O1-03, and torque reference in %.
152(98h)	This assembly provides: running, at zero speed, Drive reversing, fault reset, at speed, Drive ready, Drive alarm, Drive fault, digital output terminal status(M1, M3, M5), motor speed, speed reference and output current.
155(9Bh)	This assembly provides: running, at zero speed, Drive reversing, fault reset, at speed, Drive ready, Drive alarm, Drive fault, undervoltage, OPE error, local/remote, digital output terminal status (M1, M3, M5), output frequency as scaled by O1-03, and modbus register readout.
156(9Ch)	This assembly provides: running, at zero speed, Drive reversing, fault reset, at speed, Drive ready, Drive alarm, Drive fault, digital input terminal status (S1-S4), digital output terminal status(M1, M3, M5), output frequency as scaled by O1-03, and modbus register readout.
157(9Dh)	This assembly provides: running, at zero speed, Drive reversing, fault reset, at speed, Drive ready, Drive alarm, Drive fault, undervoltage, OPE error, local/remote, zero servo complete, digital input terminal status (S1-S12), digital output terminal status (M1, M3, M5, P3, P4), analog input terminal monitor, and output frequency as scaled by O1-03.
158(9Eh)	This assembly provides: running, at zero speed, Drive reversing, fault reset, at speed, Drive ready, Drive alarm, Drive fault, undervoltage, OPE error, local/remote, digital output terminal status (M1, M3, M5), torque monitor and Memobus parameter access.
199(C7h)	This assembly defines the COS parameters. If COS is enabled, this assembly cannot be used as polled I/O. This assembly provides: run forward, run reverse, external fault, fault reset, reference and control sources, input terminals (S3-S12), running, at zero speed, Drive reversing, fault resetting, at speed, Drive ready, Drive alarm, motor speed and motor torque.

Application Note

Classes Yaskawa

The following classes allow for direct access to drive parameters and registers

Class	Option											Description		
	CM012	CM013	CM052	CM053	CM054	CM055	CM056	CM057	CM058	CM059	V7N		SI-N3/V	
100(64h)			X								X	X	X	Parameter/Register access is provided in the following format. The Class is always 100 (64h). The Instance is the MSB of the parameter/register Memobus address and the Attribute is the LSB of the parameter/register Memobus address. For example, if you wanted to access parameter B1-01 at Memobus address 0x0180, the Class is 64h, the Instance is 01h and the Attribute is 80h.
	X	X		X			X	X	X					Digital inputs and outputs, frequency reference, torque reference, torque compensation, analog outputs, ACCEPT and ENTER commands.
101(65h)				X			X	X	X					Specific monitor parameters (see individual option documentation)
102(66h)	X			X			X	X	X					Monitor Parameters
103(67h)	X			X			X	X	X					A Parameters
104(68h)	X			X			X	X	X					B Parameters
105(69h)	X			X			X	X	X					C Parameters
106(6Ah)	X			X			X	X	X					D Parameters
107(6Bh)	X			X			X	X	X					E Parameters
108(6Ch)	X			X			X	X	X					F Parameters
109(6Dh)				X										H Parameters
110(6Eh)	X			X			X	X	X					L Parameters
							X	X	X					N Parameters
111(6Fh)	X			X										O Parameters
112(70h)	X													N Parameters (G7 Only)
	X													P Parameters (G5 Only)
113(71h)	X								X					P Parameters (F7, G7 and P7 Only)
114(72h)	X													T Parameters (F7, G7 and P7 Only)
120(78h)		X												V7 Drive Monitor Object
121(78h)		X												V7 Drive Parameter Object
125(7Dh)												X		Monitor / Control Object. Access memobus registers < 100h

Feature Description

Feature	Description
Automatic Device Recovery (ADR)	Automatic Device Recovery allows a faulted device to be replaced by another device with minimal intervention by the user. The replacement device must match the faulted device in all major aspects. For replacing a faulted Yaskawa drive, the replacement drive must at least match the Device Type, Vendor ID, Product Code and drive control mode.
Heartbeat	Device heartbeat produces a broadcast message at an interval set by attribute 10 of the Identity Object. This allows other devices on the network to determine that this device is alive and functioning.
UCMM	Unconnected Message -- Group 3 unconnected messages are supported allowing additional access for explicit messages from other nodes on the network.