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DATA SHEET
ABSOLUTE MAGNETIC ROTARY ENCODER
ANALOG

High-resolution absolute rotary encoder with analog output based on contactless magnetic Hall Effect technology. The Multi Turn rotary encoder can measure up to 65536 revolutions (16Bit). The Voltage or Current output of this rotary encoder is programmable, thus it can be scaled to fit perfect in any kind of application, particularly as a replacement for potentiometers. The PushButton and visible LED feedback makes the programming very easy. This rotary encoder can be used as a replacement for less reliable Multi Turn potentiometers. The sensor can be also used as an economical Multi Turn feedback sensor for low cost control systems with analog inputs.

Main Features

- Compact Industrial Design
- Interface: Analog – Current, Voltage
- Housing: ∅ 36,5 mm
- Shaft: ∅ 6 mm
- Blind Hollow / Hub Shaft: ∅ 6 mm
- 12 Bit Total Resolution
- Factory Default Turns: 16 (0 To 5760°)
- Inputs for User Defined Measuring Range
- Over Range and Under Range Deadband
- EMC: EN 61000-6-2, EN 61000-6-4

Mechanical Structure

- Aluminum Flange
- Coated Steel Housing
- Stainless Steel Shaft
- Precision Ball Bearings

Suitable for Applications Requiring

- Packaging machines
- Material Handling
- Buses and Trucks
- Solar Tracking
- Wind Turbines
- Construction Machines
- Defense Equipment

Electrical Features

- Reverse Voltage Protection
- Over-Voltage Protection
- Programmable Measurement Range
- Short Circuit Protection of Output

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Technical Data

Electrical Data

Current Options	4–20 mA	0–20 mA
Max Load Resistance[1)]	500 Ω	
Supply Voltage[2)]	15–30 V DC (absolute maximum ratings)	
Linearity	0.15 %	
Analog Accuracy	At 4mA = ±10µA; at 20mA = ± 50 µA	
Supply Voltage Cutoff/ Output	14.8 V / 3.6 mA	14.8 V / 0 mA
Settling Time	80 ms	
Current Consumption	Typical 40 mA	

1) Max value for supply voltage 15V. For higher supply voltage higher load resistances can be used.

2) Supply voltage according to EN 50 178 (safety extra-low voltage)

Voltage Options	0–5 V	0.5–4.5V	0–10 V	0.5–9.5V
Min Load Resistance[1)]	10 kΩ			
Supply Voltage[2)]	12-30 V DC (absolute maximum ratings)			
Linearity	0.15%			
Analog Accuracy	at 5V = ±15mV: at 10V = ± 25mV			
Supply Voltage Cutoff/ Output	11.8 / 0 V	11.8 / 0.25 V	11.8 / 0 V	11.8 / 0.25 V
Settling Time	80 ms			
Current Consumption	Typical 15 mA			

1) Min value for supply voltage 12V. For higher supply voltage lower load resistances can be used-

2) Supply voltage according to EN 50 178 (safety extra-low voltage)

General Data

Turn On Time	< 1 s
Electrical Lifetime	> 10^5 h
EMC	Emitted interference: EN 61000-6-4 Noise immunity: EN 61000-6-2 (500 V surge test)
Connection	Cable exit or M12 Connector

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Sensor Data

Single Turn Technology	Magnetic 2 axis Hall sensor
Resolution of Output[1)]	Max 12 bits over entire measuring range
Minimum Measurement Range	0 to 22.5 º
Single Turn Accuracy	Calibrated ± 0.35°
Multi Turn Technology	Self supplied magnetic pulse counter
Multi Turn Range	16 turns (default setting) User can use the scaling functionality to measure up to 65,536 turns
Signal Sense (Default)	Counterclockwise shaft movement (front view on shaft) means increasing output value

1) Fractional Turns - Resolution decreases less than 12 bits when measurement range is less than 90 degrees

Mechanical Data

Housing	Zinc Nickel Coated Steel Housing	
Flange	Aluminum	
Shaft	Stainless Steel	
Lifetime	Dependent on shaft version and shaft loading – refer to table	
Max. Shaft Load	Axial 20 N (4.5 lbs), radial 80 N (18 lbs)	
Inertia of Rotor	≤ 20 gcm^2 (0.11 oz-in^2)	
Friction Torque at +25°C	≤ 2 Ncm, (0,11 oz-in)	
RPM (continuous operation)	Max. 12.000 RPM	
Shock	EN 60068-2-27 ≤ 100 g (half sine,6 ms XYZ)	
	MIL-STD-810C ≤ 200 g (half sine, 3 ms XYZ)	
Permanent Shock	EN 60028-2-29 ≤ 10 g (half sine, 16 ms XYZ)	
	MIL-STD-810C ≤ 30 g (half sine, 11 ms XYZ)	
Vibration	EN 60068-2-6 ≤ 10 g (10 Hz – 1,000 Hz, XYZ)	
	MIL-STD-810 ≤ 4.2 g (5 Hz – 500 Hz XYZ)	
Weight (Standard Version)	≈ 150 g (0.33 lbs), including cable	

Flange	Synchro (S)	Hub shaft (B)
Shaft Diameter	6 mm (~0.236 in)	6 mm (~0.236 in)
Shaft Length	11,5 mm (~0.453 in)	–[1)]

1) Mating Shaft: min: 8 mm (~0.315 in) / max: 18 mm (~0.709 in)

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Minimum (mechanical) Lifetime

	Lifetime in 10^8 revolutions with (F_a/F_r)		
Flange	20 N/20 N	20 N/40 N	20 N/80 N
S6 Synchro Flange (MCD-…-S060-…)	224	28	3
	40 N/600 N	40 N/80 N	40 N/110 N
C100 Clamp Flange (MCD-…-C100-…)	247	104	40

Environmental Conditions

Operating Temperature Sensor[1)]	-40 – +85° (-40 – +185°F)
Storage Temperature	-40 – +85° (-42 – +185°F)
Humidity	98 % Non-condensing
Protection Class (EN 60529)[2)] Casing Side	IP 54 (molded: MCD-…-CAW and MCD-…-CRW) IP 65 (other types: MCD-…-PAM and MCD-…-GAW)
Protection Class (EN 60529) [2)] Shaft Side	IP 65 (clamp flange: MCD-…-C100-..) IP 54 (other types: MCD-…-S060-… and MCD-…-B060-…)

1) Higher temperatures [up to 125°C (257°F) for Singleturn] possible on request. See Operating Temperature: Cables

2) Higher IP ratings (up to 69K) on request

Cable[1)]

Operating Temperature Cable	Flexing -5°C to +70°C (+23 – +158°F) Static -30°C to +70°C (-22 – +158°F)
Minimum Bend Radius	Flexing 10 x cable diameter/Static 5x cable diameter
Cable	Approx ∅ 6 mm (~0.236 in)/Type : LIYCY 4x2x0.14 (~AWG 26)

1) Valid for types: MCD-…-CAW, MCD-…-GAW, MCD-…-CRW

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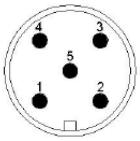
Interface

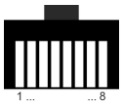
Electrical Connection

Pin M12	Pin 8P8C	Wire End	Function
1	3	Green	Current/Voltage
2	8	Red	+ V_S Supply
3	4	Yellow	GND (Supply)
4	1	White	Set 2
5	2	Browm	Set 1
Housing	–	Shielding	Shielding

Fron View



5 Pin M12 Connector Male



8P8C Modular Connector

Scaling Functionality For Non-PushButton Versions (*MCD-AX0XX-..)*

Using the Set 1 and Set 2 Input Signals the measuring range (min range of 22.5º) with the analog output range can be scaled

- Turn the shaft to the min position (One end of the measuring range).
- Connect Set 1 signal to high level for 1 second.
- Turn the encoder shaft to the max position (Other end of the measuring range).
- Connect Set 2 signal to high level for 1 second.
- Analog Output is scaled to the new measuring range.

Set 2 (White)	Set 1 (Brown)	Function
0 (Input = N.C. or GND)	0 (Input = N.C. or GND)	Normal Operation
0 (Input = N.C. or GND)	1 (Input ≥ 12V / Input ≤ V_S)	Preset Zero Point
1 (Input ≥ 12V / Input ≤ V_S)	0 (Input = N.C. or GND)	Preset Max Point
1 (Input ≥ 12V / Input ≤ V_S)	1 (Input ≥ 12V / Input ≤ V_S)	Reset Midpoint of Default Scale[1)]

1) See table on page 7 for exact values

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Scaling Functionality For PushButton Versions (*MCD-AXPXX-..)*

Using the Lim 1 and Lim 2 PushButtons on the housing the measuring range (min range of 22.5º) or the analog output range can be scaled

- Press Lim 1 and Lim 2 together for 15 sec to enter programming mode
- Turn the shaft to the min position (One end of the measuring range)
- Press Lim 1 for 1 sec
- Turn the encoder shaft to the max position
  (Other end of the measuring range)
- Press Lim 2 for 1 sec
- Analog Output is scaled to the new measuring range.

Timing Value: Operation Mode

Action	Time (Sec)	Device State
Both Buttons	15.0	Enter programming mode
Both Buttons	30.0	Reset to Mid of default
Single Button	–	Normal operation

Timing Value: Programming Mode

Action	Lim 1 pressed	Device State
Both buttons	–	Abort programming mode
Lim 1 pressed	1.0	Set position 1
Lim 2 pressed	1.0	Set position 2

LED States

Yellow LED	Green LED	Description
On	Off	Operation with default scale (“factory mode”)
Off	On	Operation with user scale
On	On	Entering programming mode (temporary state)
Flashing	Flashing	Programming mode
On	Flashing	Position 2 set, waiting for position 1
Flashing	On	Position 1 set, waiting for position 2

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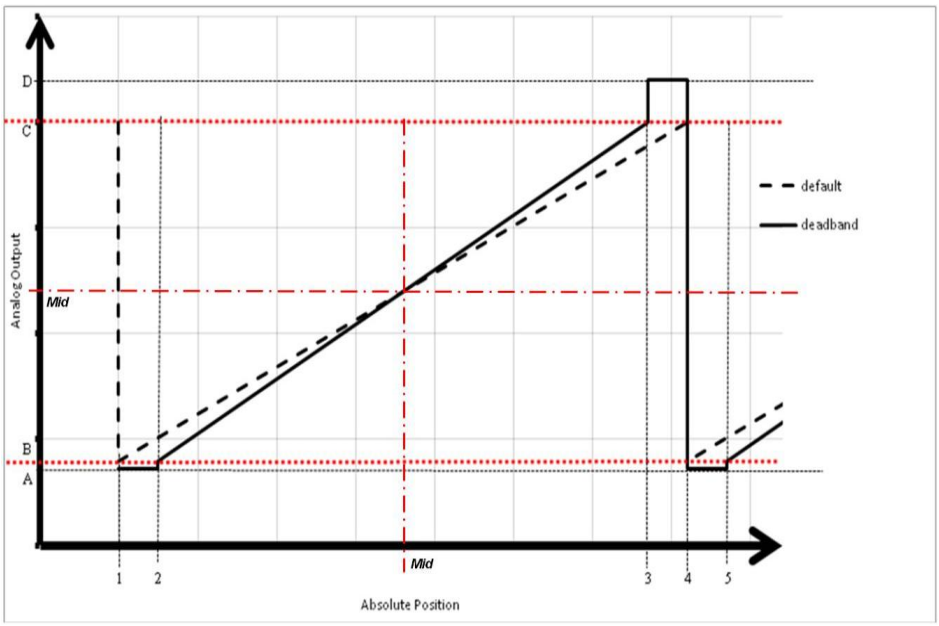
Output Characteristics



	Absolute Position in Degrees					
Encoder Type[1)]	1	2	Mid	3	4	5
MCD-AXX0X-0012-…	0	–	180º	–	360º or 0º	–
User Scaled *...-0012-…*	0	Preset Zero	–	Preset Max	360º or 0º	Preset Zero
MCD-AXX0X-0412-…	0	–	2^2*360º	–	2^4*360º or 0º	–
User Scaled[2)] *…-0412-…*	0	Preset Zero	–	Preset Max	2^n*360º or 0º	Preset Zero

n is any integer between 0 and 16 ,

1) Refer to “Models / Ordering Description” for detailed information

2) Rollover occours at 360, 720, 1440, 2880, 5760, … when user scale is less than these values.

	Analog Output Value in mA or V				
Encoder Output Type	A	B	Mid	C	D
0–5 V (*…-AVX01-.)*	–	0	2.5	5	–
0.5–4.5 V (*...-AVX03-.)*	0.25	0.5	2.5	4.5	4.75
0–10 V (*...-AVX02-.)*	–	0	5	10	–
0.5–9.5 V (*...-AVX04-.)*	0.25	0.5	5	9.5	9.75
4–20 mA (*...-ACX05-.)*	3.6	4	12	20	22
0–20 mA (*...-ACX06-.)*	–	0	10	20	–

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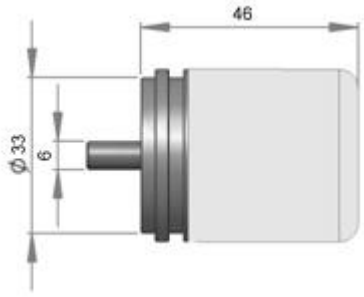
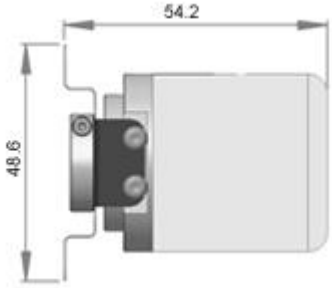
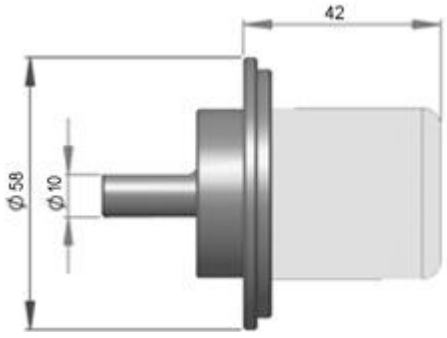
Mechanical Models

For detailed drawings please refer our website or directly contact us. Also available as IGES Drawing and STEP 3D Model.

Flange Type	Housing and Connector Type
Synchro Flange. MCD-XXXX-XXXX-S060-XXX 	Axial Cable Exit MCD-XXXX-XXXX-XXXX-CAW 
Blind Hollow Shaft / Hub Shaft MCD-XXXX-XXXX-B060-XXX 	M12 Connector MCD-XXXX-XXXX-XXXX-PAM 
Clamp Flange MCD-XXXX-XXXX-C100-XXX 	Axial Cable Exit with Gland MCD-XXXX-XXXX-XXXX-GAW 
	Radial Cable Exit MCD-XXXX-XXXX-XXXX-CRW 

All units measured in mm

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Models / Ordering Description

Description	Type key									
Magnetocode	**MCD -**	_ _	00	_ -	_ _	_ _ -	_	_ _	_ -	_ _ _
Interface[1)]	Current	**AC**								
	Voltage	**AV**								
Version	Standard		**00**							
	PushButton[2)]		P0							CRW
Code	AV = 0–5V			**1**						
	AV = 0–10 V			**2**						
	AV = 0.5–4.5 V			3						
	AV = 0.5–9.5 V			4						
	AC = 4–20 mA			5						
	AC = 0–20 mA			6						
Bits Corresponding	16 turns				**04**					
to Number of Turns	1 turns				**00**					
Bits for Max Single Turn Resolution of[3)]	4096					**12**				
Flange	Synchro Flange						**S**	06		
	Blind Hollow Shaft with flexible mount						B	06		
	Clamp Flange						C	10		
Shaft Diameter										
Mechanical Options	Without								**0**	
Connection	Cable exit, axial 1m molded									**CAW**
	Cable exit, radial 1m molded									CRW
	Cable exit, axial 1m, with cable gland									GAW
	1x 5 pin M12 connector male									PAM

Standard = bold, further models on request

1) PWM interface available on Request

2) Radial cable exit housing with 2 PushButtons for user defined scaling.

3) Would be less for a multiturn encoder. The total resolution of 12 bits shall be spread over the entire measuring range.

Ordering Example

MCD-AC005-0412-S060-CAW

MCD-AVP03-0412-C100-CRW

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Check Out Some of the Other POSITAL Products

Absolute Magnetic Encoders for Industrial Environment

To measure rotary movements or rotary displacements, an absolute magnetic rotary encoder can be used. The contact-free measuring sensor stage of the MCD Sensor does not have any abrasion. The Sensor can be connected directly to digital control units via SSI, CANopen or Analog Interface.

More Information

Heavy Duty Stainless steel Magnetic Encoders
for the Toughest Environments

Its stainless steel housing and high protection class of IP69K makes the MCD Heavy Duty rotary encoder resistant against active chemical cleaning and corrosion. Combined with the sturdy ball bearings this sensor is an ideal choice for reliable measurement under extreme environmental conditions and outdoor applications.

More Information

Tilt Sensors to Measure Inclinations up to 360°`

ACS is developed on advanced MEMS technology based capacitance measurement. The sensor is a pre-calibrated device which can be put into immediate operation, upon simple and easy installation with a three point mount and setting of preset. Its compact design, installation “anywhere” and other versatile features makes it an ideal choice for very accurate measurement.

More Information

Disclaimer

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List of types:

MCD-ACP05-0012-S060-CRW
MCD-ACP05-0012-B060-CRW
MCD-ACP05-0012-C100-CRW
MCD-ACP05-0412-S060-CRW
MCD-ACP05-0412-B060-CRW
MCD-ACP05-0412-C100-CRW
MCD-ACP06-0012-S060-CRW
MCD-ACP06-0012-B060-CRW
MCD-ACP06-0012-C100-CRW
MCD-ACP06-0412-S060-CRW
MCD-ACP06-0412-B060-CRW
MCD-ACP06-0412-C100-CRW
MCD-AVP01-0012-S060-CRW
MCD-AVP01-0012-B060-CRW
MCD-AVP01-0012-C100-CRW
MCD-AVP01-0412-S060-CRW
MCD-AVP01-0412-B060-CRW
MCD-AVP01-0412-C100-CRW
MCD-AVP02-0012-S060-CRW
MCD-AVP02-0012-B060-CRW
MCD-AVP02-0012-C100-CRW
MCD-AVP02-0412-S060-CRW
MCD-AVP02-0412-B060-CRW
MCD-AVP02-0412-C100-CRW
MCD-AVP03-0012-S060-CRW
MCD-AVP03-0012-B060-CRW
MCD-AVP03-0012-C100-CRW
MCD-AVP03-0412-S060-CRW
MCD-AVP03-0412-B060-CRW
MCD-AVP03-0412-C100-CRW
MCD-AVP04-0012-S060-CRW
MCD-AVP04-0012-B060-CRW
MCD-AVP04-0012-C100-CRW
MCD-AVP04-0412-S060-CRW
MCD-AVP04-0412-B060-CRW
MCD-AVP04-0412-C100-CRW
MCD-AC005-0012-S060-CRW
MCD-AC005-0012-S060-PAM
MCD-AC005-0012-S060-GAW
MCD-AC005-0012-S060-CAW
MCD-AC005-0012-B060-CRW
MCD-AC005-0012-B060-PAM
MCD-AC005-0012-B060-GAW
MCD-AC005-0012-B060-CAW
MCD-AC005-0012-C100-CRW
MCD-AC005-0012-C100-PAM
MCD-AC005-0012-C100-GAW
MCD-AC005-0012-C100-CAW
MCD-AC005-0412-S060-CRW
MCD-AC005-0412-S060-PAM
MCD-AC005-0412-S060-GAW
MCD-AC005-0412-S060-CAW
MCD-AC005-0412-B060-CRW
MCD-AC005-0412-B060-PAM
MCD-AC005-0412-B060-GAW
MCD-AC005-0412-B060-CAW
MCD-AC005-0412-C100-CRW
MCD-AC005-0412-C100-PAM
MCD-AC005-0412-C100-GAW
MCD-AV004-0412-C100-CAW
MCD-AC005-0412-C100-CAW
MCD-AC006-0012-S060-CRW
MCD-AC006-0012-S060-PAM
MCD-AC006-0012-S060-GAW
MCD-AC006-0012-S060-CAW
MCD-AC006-0012-B060-CRW
MCD-AC006-0012-B060-PAM
MCD-AC006-0012-B060-GAW
MCD-AC006-0012-B060-CAW
MCD-AC006-0012-C100-CRW
MCD-AC006-0012-C100-PAM
MCD-AC006-0012-C100-GAW
MCD-AC006-0012-C100-CAW
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MCD-AC006-0412-S060-CAW
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MCD-AC006-0412-C100-CAW
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MCD-AV001-0012-S060-GAW
MCD-AV001-0012-S060-CAW
MCD-AV001-0012-B060-CRW
MCD-AV001-0012-B060-PAM
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MCD-AV001-0012-B060-CAW
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MCD-AV001-0012-C100-PAM
MCD-AV001-0012-C100-GAW
MCD-AV001-0012-C100-CAW
MCD-AV001-0412-S060-CRW
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MCD-AV001-0412-S060-GAW
MCD-AV001-0412-S060-CAW
MCD-AV001-0412-B060-CRW
MCD-AV001-0412-B060-PAM
MCD-AV001-0412-B060-GAW
MCD-AV001-0412-B060-CAW
MCD-AV001-0412-C100-CRW
MCD-AV001-0412-C100-PAM
MCD-AV001-0412-C100-GAW
MCD-AV001-0412-C100-CAW
MCD-AV002-0012-S060-CRW
MCD-AV002-0012-S060-PAM
MCD-AV002-0012-S060-GAW
MCD-AV002-0012-S060-CAW
MCD-AV002-0012-B060-CRW
MCD-AV002-0012-B060-PAM
MCD-AV002-0012-B060-GAW
MCD-AV002-0012-B060-CAW
MCD-AV002-0012-C100-CRW
MCD-AV002-0012-C100-PAM
MCD-AV004-0412-C100-GAW
MCD-AV002-0012-C100-GAW
MCD-AV002-0012-C100-CAW
MCD-AV002-0412-S060-CRW
MCD-AV002-0412-S060-PAM
MCD-AV002-0412-S060-GAW
MCD-AV002-0412-S060-CAW
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MCD-AV002-0412-B060-GAW
MCD-AV002-0412-B060-CAW
MCD-AV002-0412-C100-CRW
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MCD-AV002-0412-C100-CAW
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MCD-AV003-0012-S060-GAW
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MCD-AV003-0012-B060-CRW
MCD-AV003-0012-B060-PAM
MCD-AV003-0012-B060-GAW
MCD-AV003-0012-B060-CAW
MCD-AV003-0012-C100-CRW
MCD-AV003-0012-C100-PAM
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MCD-AV004-0012-S060-CAW
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MCD-AV004-0012-B060-CAW
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MCD-AV004-0012-C100-PAM
MCD-AV004-0012-C100-GAW
MCD-AV004-0012-C100-CAW
MCD-AV004-0412-S060-CRW
MCD-AV004-0412-S060-PAM
MCD-AV004-0412-S060-GAW
MCD-AV004-0412-S060-CAW
MCD-AV004-0412-B060-CRW
MCD-AV004-0412-B060-PAM
MCD-AV004-0412-B060-GAW
MCD-AV004-0412-B060-CAW
MCD-AV004-0412-C100-CRW
MCD-AV004-0412-C100-PAM