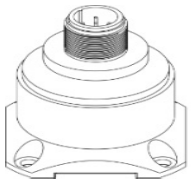
DKA-300 Series
Low-Cost Triaxial MEMS Digital Accelerometer



Jewell Instruments DKA Series Accelerometers are an excellent choice for cost to performance trade off. The DKA is based on silicon micro-machined MEMS Capacitive Accelerometer technology and designed for low power and high stability.

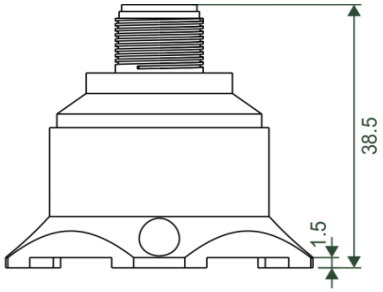
FEATURES

- Triaxial Configuration
- Measuring ranges of ±2G thru ±40G
- 100g shock protection
- Up to 1000 Hz bandwidth
- Ruggedized for harsh environment operation
- IP67 rating
- High Sensitivity with 1mg resolution
- RS232, RS485, MODBUS, and TTL Digital Interface outputs
- 9-36Vdc input voltage
- 2 meter cable whip (Included)
- M12 connector

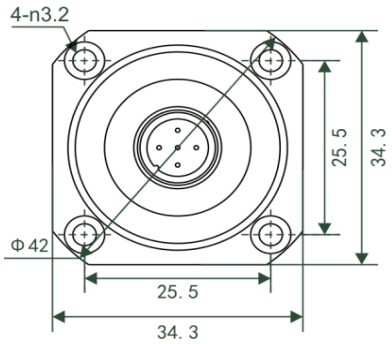
APPLICATIONS

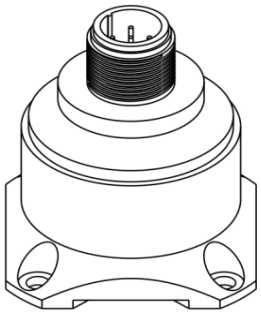
- Tower Cranes
- Wind Power Monitoring
- Robotics
- Traffic System Analysis
- Low Frequency Vibration Measurement
- Medical Equipment testing
- Automatic Control Systems
- Large Machinery Monitoring
- Vehicle Testing

OUTLINE DIAGRAM



Size:34.3*34.3*38.5mm





PIN OUT

SPECIFICATIONS

STATIC/DYNAMIC

Measurement Range, (g)	±2	±4	±8	±10	±20	±40
Output Interface	RS232, RS485, RS485 MODBUS, and TTL					
Calibration Deviation (mg)	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Measuring Axis	X, Y, & Z (3-axis)					
Bias Temp Coefficient (%/°C)	0.01	0.01	0.01	0.01	0.01	0.01
0° Output Error (mA)	<0.005	<0.005	<0.005	<0.003	<0.003	<0.003
Cross Axis Sensitivity (%)	1.0	1.0	1.0	2.0	2.0	2.0
Resolution @ 1Hz (mg, max)	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Nonlinearity (% of Full Scale, Max.)	<0.5	<0.8	<1.0	<1.0	<1.0	<1.0
Lateral Vibration Sensitivity Ratio (%)	1.0	1.0	2.0	5.0	5.0	5.0
Frequency Response (Hz)	500	500	500	500	500	500
Bandwidth (Hz, 3db)	1000	1000	1000	1000	1000	1000
Noise Spectral Density (µg/√Hz)	21.0	21.0	21.0	86.6	86.6	86.6
Output Rate (Hz)	5, 10, 25, 50, 100, 200, 500, and 1000					
Protocol	Jewell Std Protocol and MODBUS RTU Protocol					

ELECTRICAL AND ENVIRONMENTAL

Input Voltage (Vdc)	9 to 36 Vdc
Operating Current	<60mA at 12Vdc
Operating Temperature	-40°C to +85°C
Storage Temperature	-55°C to +100°C
Shock Resistance	100g (11msec ½ sine)
Vibration (grms random 20 to 2,000 Hz)	20

MECHANICAL

Enclosure Dimensions	34.3mm (L) x 34.3mm (W) x 38.5mm (H)
Weight (grams)	73.5
Seal	IP67
Connector	Standard M12

Notes: 1 - Intermediate ranges available, please see model number structure below. Custom ranges available on request.

2 - Output voltage 0.5-4.5 Vdc (- Full Scale to + Full Scale, Zero g = 2.5Vdc)

*Specifications subject to change without notice due to continued product development

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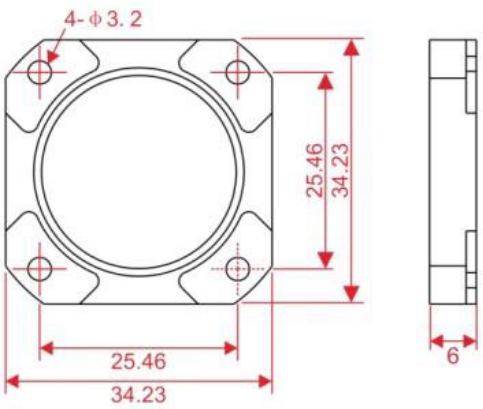
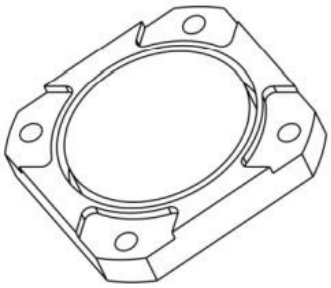
AKA AND DKA SERIES ACCESSORIES

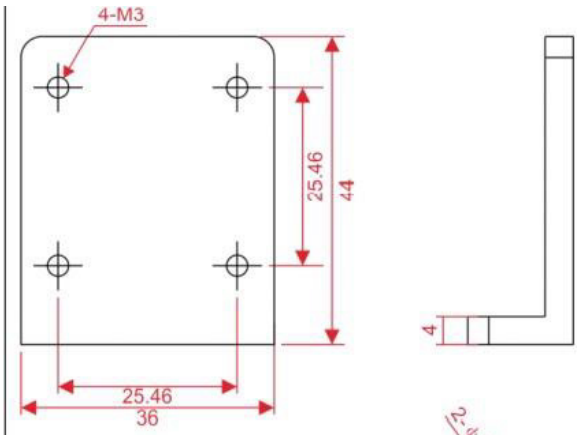
Magnetic Base

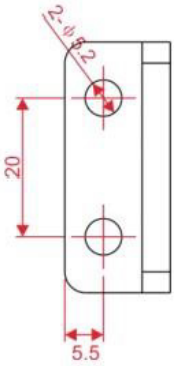




PN: TBD

L-Style Mounting Bracket





PN: TBD

HOW TO ORDER:

DKA	-	300	-	C	-	XX	-	XXX	-	XX
Digital Series		Tri-axis (X, Y, X)		C: M12 Connector		Range		Interface		Protocol
						02 - ±2g		232: RS232		Blank - Jewell Protocol
						04 - ±4g		485: RS485		MB - MODBUS RTU
						08 - ±8g		TTL: TTL Level		
						10 - ±10g				
						20 - ±20g				
						40 - ±40g				

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COMMUNICATING PROTOCOL (JEWELL CUSTOM PROTOCOL)

1. DATA FRAME FORMAT : (8 bits date, 1 bit stop, No check, Default baud rate 9600)

Identifier (1byte)	Date Length (1byte)	Address code (1byte)	Command word (1byte)	Date domain	Check sum (1byte)
68					

data format : Hex
Identifier：Fixed68H
Data length：From data length to check sum（including check sum）length
Address code：Accumulating module address，Default :00
Date domain will be changed according to the content and length of command word
Check sum：Data length、Address code、Command word and data domain sum,No carry.

2. Command word analysis

Desc.	Meaning/Example	Description
0X04	**Meanwhile reading the angle command** E.g: ***68 04 00 04 08***	Data domain(0byte) No Data domain command
0X84	Sensor answer reply E.g: **68 0D 00 84 00 20 10 10 40 00 05 05 00 1B**	Data domain (9byte) AA AB BB CC CD DD EE EF FF AA AB BB:three character means X axis CC CD DD:three character means Y axis EE EF FF:3 characters means temperature data The angle format is the same as the X axis or Y axis analysis method. The angle in the left example: X axis 02.010G,Y axis -04.000G Z axis : +50.500 00 20 10 red three bytes return the angle value for the X-axis , For compressed BCD codes , The upper 0 of the first byte is the sign bit (0 positive, 1 negative) 02 is a two-digit integer value, 010 is a three-digit decimal value. The other axis data parsing methods are the same, This angle is resolved to +02.010 degrees. 10 40 00 Blue three bytes return the angle value for the Y axis, the analytical method is the same as the X axis. 05 05 00 Green three bytes are the internal temperature value of the product, and the analytical method is the same as the X-axis angle. 1B: checksum, all data hexadecimal sum, no prefix 68
0X0B	**Setting communication rate** **E.g: *68 05 00 0B 03 13*** The command setting is effective after power off then restart (power off with save function)	Data domain（1byte） Baud rate：default :9600 00 means 2400 01 means 4800 02 means 9600 03 means 19200 04 means 38400 05 means 115200 06 means 230400
0X8B	Sensor answer reply command E.g: **68 05 00 8B 00 90**	Data domain（1byte） Data domain in the number means the sensor response results 00 Success FF Failure

0X0C	**Setting sensor output mode** Response rule; Need upper computer send reading angle command , the sensor answer the corresponding angle Automatic output rule: The sensor with power on can Automatically output X,Y angle , The output frequency base on what be setted, if you need output High frequency, please set baud rate as 115200 (Power off with save function) E.g: ***68 05 00 0C 00 11***	Data domain （1byte）Factory default: 00 00 应答制式 01 5Hz Auto output mode 02 10Hz Auto output mode 03 25Hz Auto output mode 05 50Hz Auto output mode 06 100Hz Auto output mode 07 200Hz Auto output mode 08 500Hz Auto output mode (Baud rate adopt 115200、230400) 09 1000Hz Auto output mode (Baud rate adopt 230400)
0X8C	Sensor answer reply command E.g: **68 05 00 8C 00 91**	Data domain（1byte） Data domain in the number means the sensor response results 00 Success FF Failure
0X0F	**Setting module address command** The sensor default address is 00, 1, such as a plurality of sensor to be connected with a bus cable, e.g RS485.requires each sensor is set to a different address, in order to achieve control and response angle . 2, If successfully changed the new address, follow all of the commands and responding Packet address code has to switch to the new address code which already changed then to be effective, otherwise the sensor will not respond to commands.(power off with save function) E.g: ***68 05 00 0F 01 15*** Setting the address to 01 ***68 05 FF 0F 00 13*** Use the common address to reset address to 00	Data domain （1byte）XX Module address Address from 00 to EF range Note: All products have a common address :FF, If forget the address what has been set during operation , can use **FF address to operate the product can still normally respond.**
0X8F	The sensor answer reply command E.g: 68 05 00 8F 94	Data domain（1byte）, Data domain in the number means the sensor response results 00 Success FF Failure
0X53	Set save command 68 04 00 53 57	
0XD3	Set save command reply 68 05 00 D3 00 D8	Data domain (0BYTE) Data domain in the number means the sensor response results 00 Success FF Failure
0XFF	Read version software number instruction 68 04 00 FF 03	
	Read software version reply AKE392,SW V1.1	Data domain (BYTE) Data domain in the number means the sensor response results Return is in ASCII code format , model (AKE392) , Software version number 1.1

3. Setting instructions and processes

3.1.Set related parameters(Baud rate, address code, automatic output frequency.)Only valid settings are set at this time, but not saved to FLASH,. Power down is not saved. A Set address code B Set baud rate C Set the calibration parameters D Automatic or inquiry mode ! ! **Notice , Take effect immediately after setting the address code and baud rate (but not saved to FLASH) , The subsequent operation instructions need to change the corresponding address code and baud rate to be set successfully.**

MODBUS RTU PROTOCOL

1. Data frames format:

RTU Mode

Communication Parameter : Baud rate 9600 bps

Data frames : 1 Start bit , 8 datas , even parity check , 1 stop bit

Please read the following items carefully before use:

1) Because of the MODBUS protocol stipulates between the two data frames should be at least more than 3.5 bytes of time (such as the baud rate of 9600, the time is 3.5 X (1/9600) X 11=0.004s). However, in order to leave enough margin, the sensor will be increased this time to 10ms, so please leave at least of the time interval between each data frame.

The master computer sends commands — — 10ms idle — — slave computer reply command — — 10ms idel - The master computer sends commands.....

2) MODBUS protocol stipulates the broadcast address ----0 relevant content, the sensor can also accept the broadcast address content, but will not reply. Therefore, the broadcast address 0 can be used for the following purposes, for reference only.

1 All the sensors mounted on BUS are all set to an address.

2 All the sensors mounted on BUS are all set to relative / absolute zero.

3 Test all sensors mounted on BUS , that is, the master computer send 0 address to BUS for query angle command, communication lights can flicker that means the communication is normal.

3) In order to improve the reliability of the system, set the address command and set the absolute / relative command, set the baud rate, these three commands must be sent for two consecutive times will be valid. "Two consecutive send" refers to two times sent successfully (the slave machine reply every time) ,must be consecutive in two times, that's means the master compuetr can not insert other frames in the midele of two replies , otherwise, the command will be locked until the power off ,

setting process refer to below :

Send set address command — — waiting for the slave compueter to send command of successful commands - (no other commands) to send the set address command again - waiting for the successful settings from the slave computer to send the command - modify the success

4) After power up, the above two sets of commands can be set only once, if necessary, again need to re power.

5) When the normal communication accumulated to a certain number of times, the communication indicator will flash once.

2. Read angle data:

Modbus FUNC 03H

Master Computer Inquiry Command:		Slave Computer Response:		
Inclinometer Address	01H	Inclinometer Address	01H	
FUNC	03H	FUNC	03H	
Visit Register	00H	Data Length 8 bytes	09H	
first Address	02H	Data word 1 upper 8 bits	50H	X Axis Data
Data Length 4	00H	Data word 1 lower 8 bits	46H	
bytes	04H	Data word 2 upper 8 bits	00H	
CRC	E5C9H	Data word 2 lower 8 bits	23H	
		Data word 3 upper 8 bits	20H	Y Axis Data
		Data word 3 lower 8 bits	00H	
		Data word 4 upper 8 bits	00H	
		Data word 4 lower 8 bits	00H	Z Axis Data
		Data word 5 upper 8 bits	00H	
		CRC	B827H	

Read the measured data command applicaton example 1:								
Master computer sending	01 H	03 H	00 H	02 H	00 H	04 H	E5H	C9H

Slave computer response												
01H	03H	08H	50H	46H	00H	23H	20H	00	00H	00H	B8H	27H

X Axis is the1-3bytes of the data domain , Y Axis is the 4-6 bytes of the data domain , Low byte in front. Angle representation method for point representation, a point corresponding to 0.001°, 0.001 x (points -offset) is the angle.If the measurement range is +-8G , a total point number is16000.

Take the data frame as an example: the angle conversion process is as follows:

1) Get the current point of view, note, low byte in the front, the X axis is 4650H, Y axis is2023H,Z axis is0.

2) convert to decimal, X axis: 4650H→18000, Y axis: 2023H→8227, Z axis is 0.

3) Minus offset 90000 (Note: this value is a fixed value) , X axis : 18000-90000=-72000 , Y axis : 8227-90000 = -891773, Z axis 0-90000=-90000。

4) Get the final accelerometer , X axis : -72000×0.001= -72.000G , Y axis : -81773×0.001=-81.773G , Z axis : -90000×0.001=-90G。

5) Note : Master computer response data domain of the frames is 50H , 46H , 00H , 00H , 23H , 20H , 00H , 00H .

3. Set sensor address:

Set the sensor address code command:		Slave response :	
Sensor address	01H	Sensor Address	01H
FUNC	06H	FUNC	06H
address	00H	register address	00H
	11H		11H
New address of the sensor	00 H	New address of the sensor	00H
	04H		04H
CRC	D80C	CRC	D80C

Commands must be sent two times to be valid

Set sensor address command example:								
Master computer sending	01H	06H	00H	11H	00H	04H	D8H	0CH

Slave computer response							
01H	06H	00H	11H	00H	04H	D8 H	0CH

Note: 0011H is the register address, which controls the sensor address. In the example above, the address of the sensor is changed to 0004H, and the last two bytes are CRC checksum.

4. Set sensor buad rate: (factory deflaut 9600 bps)

Set sensor address code command:		Slave computer response:	
Sensor address	01H	Sensor Address	01H
FUNC	06H	FUNC	06H
address	00H	register address	00H
	12H		12H
Baud rate of the sensor	00H	Baud rate of the sensor.	00H
	XX		XX
CRC	CRC LH	CRC	CRC LH

XX : A0H:4800 A1H:9600 A2H:19200 A3H:38400 A4H:115200

Set sensor address command example:								
Master computer sending	01H	06H	00H	12H	00H	A2H	A8H	76H

Slave computer response							
01H	06H	00H	12 H	00 H	A2H	A8H	76H

Note: 0012H is the register address, which controls the baud rate of the sensor. In the above example, the baud rate of the sensor is set to 19200, and the last two bytes are CRC checksum.

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5. Set sensor comminication character format: (Factory default is even parity)

Set sensor address code command :		Slave response :	
Sensor Address	01H	Sensor Address	01H
FUNC	06H	FUNC	06H
address	00H	register	00H
	09H	address	09H
Sensor changes communication character format	00 H	New format of sensors	00H
	01H		01H
CRC	9808	CRC	9808

Note: Jewell custom protocol and MODBUS protocol switch methods to each other:

At power-on, the upper computer always sends 0xAA. When the accelerometer returns 0xAA, 0XAA, 0XBB, 0XBB, the change is sucessful.