Array instruction

The new KPLC provides a set of array instructions for the convenience of users. The specific models and software versions that support array instructions are shown in the table below.

CPU type	Firmware version	Programming software version
K209M	Any version is supported	KincoBulider V8.1.0.0 and later versions
KS101M		
K6 series		

6.9.1 Overview of Array Instructions

In practical application programming, we will encounter requirements such as mathematical processing of large amounts of data or repeated calls to some single logic. If basic logic instructions and mathematical operation instructions are used for processing, a large number of programs need to be written, which is inconvenient to use and occupies program space. Using array instructions can effectively solve such problems and make the program simple and clear.

Array refers to a collection used to store multiple data of the **same data type**. It is a form in which several elements of the same type are organized together for the convenience of processing in program design.

KPLC supports multiple arrays, each array is assigned a unique number, and the user operates the corresponding array through the number in the program. In the following, we usually refer to the array numbered N by "array N". For example, K6 provides 16 arrays, and their numbers are integers from 0 to 15. In the user program, all array instructions whose input parameter "ARRAY" is "1" are to operate "array 1" (i.e. the array numbered "1").

Each data stored in the array is called the element of the array, and each array is allowed to store up to 1024 elements. In an array, in order to distinguish each element, each element position is assigned a unique number number, which is called a subscript, and the user operates the corresponding element in the array through the subscript in the program. For example, the maximum number of elements in a single KPLC array is 1024, and the subscripts of each element are from 0 to 1023 in sequence.

Arrays have data types. When a data type is specified for an array, it means that all elements in the array have the same data type. For example, the data type of "array 0" is INT, then the data type of all elements in this array is INT.

The following table shows an example of the composition of an array.

array number	Subscript 0	subscript1	subscript2	subscript3	Description
8	DI#252	DI#-3	DI#16	DI#678	The array numbered 8 (array 8), its data type is DINT, contains a total of 4 elements of

					subscript 0-3. In this example, the element value of the subscript 2 in array 8 is DI#16.

In order to facilitate the use of arrays, KincoBuilder provides the following array-related instructions, which are located in the [Array Instructions] group of the instruction set.

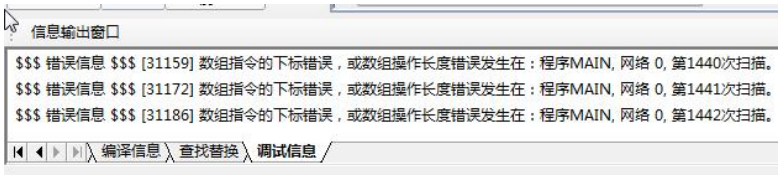
Name	Description
A_READ	read element in array
A_WRITE	write element in array
A_FILL	fill array
A_GETSIZE	Get the length (size) of an array
A_SETSIZE	Set the length (size) of the array
A_GETTYPE	Get the data type of an array element
A_SETTYPE	Set the data type of an array element
A_MIN	Find the minimum value of the data in the specified range in the array
A_MAX	Find the maximum value of data within a specified range in an array
A_AVE	Find the average of data within a specified range in an array
A_SUM	Find the sum value of the data in the specified range in the array
A_SORT	Sorts the data in the specified range in the array

1) **Precaustions**

When using these instructions, users should pay attention to the following points:

- Only one-dimensional arrays are supported, two-dimensional arrays, three-dimensional arrays, etc. are not supported.
- In a user project, a total of 16 array numbers can be used, and the numbers are 0-15 in sequence. The maximum number of elements in each array is 1024, and the subscript numbers of the elements are 0-1023.
- The number of elements of an array can be specified with the A_SETSIZE directive. If not specified, a maximum of 1024 elements is supported by default. However, it is recommended that the user first specify the number of array elements when using it.
- Array supports all data types (BOOL, BYTE, WORD, DWORD, INT, DINT, REAL). Users can call the A_SETTYPE instruction to specify the data type of the array. If no data type is specified, the array allows elements of all data types to be stored by default, but it is recommended that users specify a data type for the array first. Before using A_MIN, A_MAX, A_AVE, A_SUM and other operation instructions, you must use the A_SETTYPE instruction to specify the data type of the array.
- If the elements in the array are not initialized and assigned (the A_FILL instruction can be used), each element will use the default initial value according to the data type, for example, the initial value of BOOL type is FALSE, and the initial value of REAL type is 0.0.
- The memory space occupied by the array is independent and does not occupy basic memory space such as V and M. **The array does not support power-down save!**
- The array instruction provides information output such as execution error (as shown in the

figure below), but does not provide parameters such as instruction execution error output. It is recommended that the user reasonably plan the data type, element, array number, length, etc. of the array before use to avoid errors.

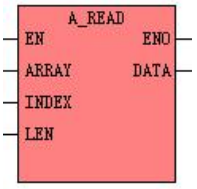


- All input parameters using array instructions need to be careful not to exceed the allowable range, such as array number, element subscript, etc. After the execution of the array instruction fails, an error code will be generated, which can be read with KincoBuilder.

Error code	Description
600	The array number of the array instruction is wrong
601	Subscript error for array instruction, or wrong length for array operation
602	The array instruction operates on an unsupported data type or is inconsistent with the array data type explicitly specified by the user
603	The array operation has the wrong length, or exceeds a user-specified array length limit
606	The memory area of the input and output of the array instruction is insufficient, for example, the back boundary of the output memory area is exceeded
607	Unsupported sort order

6.9.2 array instruction

6.9.2.1 A_READ（read array element）

	Name	Instruction format	Applicable products
LD	A_READ		☑ K209M ☑ KS101M ☑ K6

Parameter	Input/Output	Datatype	Value range	Memory area allowed
ARRAY	Input	INT	0-15	I、Q、V、M、L、constant
INDEX	Input	INT	0-1023	I、Q、V、M、L、constant
LEN	Input	INT	1-1024	I、Q、V、M、L、constant
DATA	Output	BOOL,BYTE, WORD,DWORD INT,DINT, REAL	----	V、M、L

For the specific usage instructions of each parameter, see the following table:

Parameter	Function
EN	enable terminal. If EN is 1, the instruction is enabled and execution is allowed.
ARRAY	Array number to use, in the range 0-15
INDEX	The starting index address of the object to be accessed in the array, range 0-1023
LEN	Read the number of array elements, range 1-1024
DATA	The starting address where the read data is stored

Note: ARRAY, INDEX, LEN must be constant or variable at the same time, and these parameters form a variable-length memory block. This memory block must all be located in a legal memory area, otherwise the array instruction will be executed incorrectly.

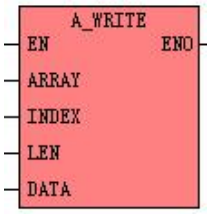
This instruction is used to copy and transfer the consecutive LEN elements from the starting element of the INDEX parameter in the array numbered ARRAY to the consecutive LEN variables starting from the address DATA. The transmitted data type remains the same, and the maximum length of the transmission should not exceed the maximum valid element range of 1024, nor should it exceed the valid element range of the array specified by the A_SETSIZE instruction.。

- LDFormat instruction description

If EN is 1, the instruction is executed.

If EN is 0, the instruction is not scanned and will not be executed.

6.9.2.2 A_WRITE（write array element）

	Name	Instruction format	Applicable products
LD	A_WRITE		☑ K209M ☑ KS101M ☑ K6

Parameter	Input/Output	Datatype	Value range	Memory area allowed
ARRAY	Input	INT	0-15	I、Q、V、M、L、constant
INDEX	Input	INT	0-1023	I、Q、V、M、L、constant

LEN	Input	INT	1-1024	I、Q、V、M、L、constant
DATA	Input	BOOL,BYTE, WORD,DWORD INT,DINT, REAL	----	I、Q、V、M、L

Note: ARRAY, INDEX, LEN must be constants or variables at the same time, and these parameters form a variable-length memory block. This memory block must all be located in a legal memory area, otherwise the array instruction will be executed incorrectly.

Note: VWxxx is recorded in WORD type by default, and VDxxx is recorded in DWORD type by default. If you want to record as INT or DINT and then perform various operations, you need to declare INT or DINT in the global variable table first, and then enter it in the DATA parameter of A_WRITE.

For the specific usage instructions of each parameter, see the following table:

Parameter	Function
EN	enable terminal. If EN is 1, the instruction is enabled and execution is allowed.
ARRAY	Array number to use, in the range 0-15
INDEX	The starting index address of the object to be accessed in the array, range 0-1023
LEN	Number of elements to write to the array, range 1-1024
DATA	The starting address where the write data is stored

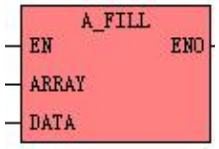
This instruction is used to write the consecutive LEN variables starting from the address DATA into the consecutive LEN elements starting from the starting element of the INDEX parameter in the array numbered ARRAY. The written data type must be consistent with the data type of the array specified by the A_SETTYPE instruction. . The maximum length transferred should not exceed the maximum valid element range of 1024, nor should it exceed the valid element range for this array specified by the A_SETSIZE directive.

• LDFormat instruction description

If EN is 1, the instruction is executed.

If EN is 0, the instruction is not scanned and will not be executed.

6.9.2.3 A_FILL（fill array elements）

	Name	Instruction format	Applicable products
LD	A_FILL		☑ K209M ☑ KS101M ☑ K6

Parameter	Input/Output	Datatype	Value range	Memory area allowed
ARRAY	Input	INT	0-15	I、Q、V、M、L、constant
DATA	Input	BOOL,BYTE, WORD,DWORD INT,DINT, REAL	----	I、Q、V、M、L、constant

For the specific usage instructions of each parameter, see the following table:

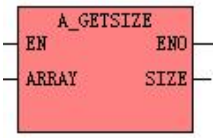
Parameter	Function
EN	enable terminal. If EN is 1, the instruction is enabled and execution is allowed.
ARRAY	Array number to use, in the range 0-15
DATA	Fill array elements with numeric values

This instruction is used to assign all valid elements in the array numbered ARRAY to the value of DATA. Note that the data type of DATA must be consistent with the data type of the array.

• LDFormat instruction description

If EN is 1, the instruction is executed.If EN is 0, the instruction is not scanned and will not be executed.

6.9.2.4 A_GETSIZE（Get the valid range of array elements）

	Name	Instruction format	Applicable products
LD	A_GETSIZE		☑ K209M ☑ KS101M ☑ K6

Parameter	Input/Output	Datatype	Value range	Memory area allowed
ARRAY	Input	INT	0-15	I、Q、V、M、L、constant
SIZE	Output	INT	1-1024	V、M、L

For the specific usage instructions of each parameter, see the following table:

Parameter	Function
EN	enable terminal. If EN is 1, the instruction is enabled and execution is allowed.
ARRAY	Array number to use, in the range 0-15
SIZE	Valid length of array elements, in the range 1-1024

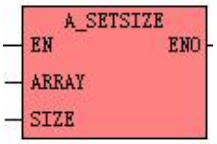
This instruction is used to obtain the size (ie the number of elements) of the array numbered ARRAY, and write the result to SIZE.

- LDFormat instruction description

If EN is 1, the instruction is executed.

If EN is 0, the instruction is not scanned and will not be executed.

6.9.2.5 A_SETSIZE（Set the valid range of array elements）

	Name	Instruction format	Applicable products
LD	A_SETSIZE		☑ K209M ☑ KS101M ☑ K6

Parameter	Input/Output	Datatype	Value range	Memory area allowed
ARRAY	Input	INT	0-15	I、Q、V、M、L、constant
SIZE	Input	INT	1-1024	I、Q、V、M、L

For the specific usage instructions of each parameter, see the following table:

Parameter	Function
EN	Enable side. If EN is 1, the instruction is enabled and execution is allowed.
ARRAY	The array number used, in the range 0-15
SIZE	The valid length of the array elements, in the range 1-1024

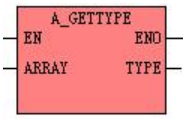
This instruction is used to set the maximum number of elements allowed in an array numbered ARRAY to SIZE.

• LDFormat instruction description

If EN is 1, the instruction is executed.

If EN is 0, the instruction is not scanned and will not be executed.

6.9.2.6 A_GETTYPE（Get the data type of an array element）

	Name	Instruction format	Applicable products
LD	A_GETTYPE		☑ K209M ☑ KS101M ☑ K6

Parameter	Input/Output	Datatype	Value range	Memory area allowed
ARRAY	Input	INT	0-15	I、Q、V、M、L、Constant
TYPE	Output	INT		V、M、L

For the specific usage instructions of each parameter, see the following table:

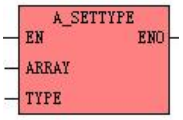
Parameter	Function
EN	enable terminal. If EN is 1, the instruction is enabled and execution is allowed.
ARRAY	Array number to use, in the range 0-15
TYPE	The data type of the array elements, the specific values are as follows: Default type 0 BOOL_TYPE 1 BYTE_TYPE 2 WORD_TYPE 3 INT_TYPE 4 DWORD_TYPE 5 DINT_TYPE 6 REAL_TYPE 7

This instruction is used to obtain the data type of the array numbered ARRAY, and write the result to TYPE.

• LDFormat instruction description

If EN is 1, the instruction is executed. If EN is 0, the instruction is not scanned and will not be executed.

6.9.2.7 A_SETTYPE（Set the data type of an array element）

	Name	Instruction format	Applicable products
LD	A_SETTYPE		☑ K209M ☑ KS101M ☑ K6

Parameter	Input/Output	Datatype	Value range	Memory area allowed
ARRAY	Input	INT	0-15	I、Q、V、M、L、constant
TYPE	Input	INT	0-7	I、Q、V、M、L

For the specific usage instructions of each parameter, see the following table:

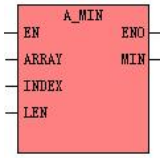
Parameter	Function
EN	enable terminal. If EN is 1, the instruction is enabled and execution is allowed.
ARRAY	Array number to use, in the range 0-15
TYPE	Data type of array elements: default type 0 BOOL_TYPE 1 BYTE_TYPE 2 WORD_TYPE 3 INT_TYPE 4 DWORD_TYPE 5 DINT_TYPE 6 REAL_TYPE 7

This instruction is used to set the data type supported by the array numbered ARRAY to TYPE.

• LDFormat instruction description

If EN is 1, the instruction executes. If EN is 0, the instruction is not scanned and will not be executed.

6.9.2.8 A_MIN（The minimum value of the data in the specified range in the array）

	Name	Instruction format	Applicable products
LD	A_MIN		☑ K209M ☑ KS101M ☑ K6

Parameter	Input/Output	Datatype	Value range	Memory area allowed
ARRAY	Input	INT	0-15	I、Q、V、M、L、constant
INDEX	Input	INT	0-1023	I、Q、V、M、L、constant
LEN	Input	INT	1-1024	I、Q、V、M、L、constant
MIN	Output	BYTE, WORD,DWORD, INT,DINT, REAL	----	V、M、L

For the specific usage instructions of each parameter, see the following table:

Parameter	Function
EN	enable terminal. If EN is 1, the instruction is enabled and execution is allowed.
ARRAY	Array number to use, in the range 0-15
INDEX	The starting index address of the object to be accessed in the array, range 0-1023
LEN	Number of array elements for data operations, range 1-1024
MIN	The memory address where the minimum value obtained by the operation is stored

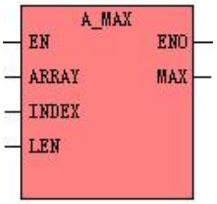
Note: ARRAY, INDEX, LEN must be both constants or variables at the same time! Before using this instruction, you must set the data type of the array with the A_SETTYPE instruction, and this instruction does not support the operation of BOOL type arrays.

This instruction is used to take the minimum value of consecutive LEN elements starting from INDEX in the array numbered ARRAY, and the obtained minimum value is stored in the memory address specified by MIN.

• LDFormat instruction description

If EN is 1, the instruction executes. If EN is 0, the instruction is not scanned and will not be executed.

6.9.2.9 A_MAX（The maximum value of data within a specified range in an array）

	Name	Instruction format	Applicable products
LD	A_MAX		☑ K209M ☑ KS101M ☑ K6

Parameter	Input/Output	Datatype	Value range	Memory area allowed
ARRAY	Input	INT	0-15	I、Q、V、M、L、constant
INDEX	Input	INT	0-1023	I、Q、V、M、L、constant
LEN	Input	INT	1-1024	I、Q、V、M、L、constant
MAX	Output	BYTE, WORD,DWORD INT,DINT, REAL	----	V、M、L

For the specific usage instructions of each parameter, see the following table:

Parameter	Function
EN	enable terminal. If EN is 1, the instruction is enabled and execution is allowed.
ARRAY	Array number to use, in the range 0-15
INDEX	The starting index address of the object to be accessed in the array, range 0-1023
LEN	Number of array elements for data operations, range 1-1024
MAX	The memory address where the maximum value obtained by the operation is stored

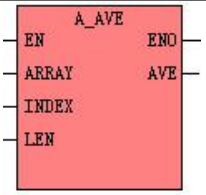
Note: ARRAY, INDEX, LEN must be both constants or variables at the same time! Before using this instruction, you must set the data type of the array with the A_SETTYPE instruction, and this instruction does not support the operation of BOOL type arrays.

This instruction is used to take the maximum value of consecutive LEN elements starting from INDEX in the array numbered ARRAY, and the obtained minimum value is stored in the memory address specified by MAX.

• LDFormat instruction description

If EN is 1, the instruction executes. If EN is 0, the instruction is not scanned and will not be executed.

6.9.2.10 A_AVE（The average of data within a specified range in an array）

	Name	Instruction format	Applicable products
LD	A_AVE		☑ K209M ☑ KS101M ☑ K6

Parameter	Input/Output	Datatype	Value range	Memory area allowed
ARRAY	Input	INT	0-15	I、Q、V、M、L、constant
INDEX	Input	INT	0-1023	I、Q、V、M、L、constant
LEN	Input	INT	1-1024	I、Q、V、M、L、constant
AVE	Output	BYTE, WORD,DWORD INT,DINT, REAL	----	V、M、L

For the specific usage instructions of each parameter, see the following table:

Parameter	Function
EN	enable terminal. If EN is 1, the instruction is enabled and execution is allowed.
ARRAY	Array number to use, in the range 0-15
INDEX	The starting index address of the object to be accessed in the array, range 0-1023
LEN	Number of array elements for data operations, range 1-1024
AVE	The memory address where the average value obtained by the operation is stored

Note: ARRAY, INDEX, LEN must be both constants or variables at the same time! Before using this instruction, you must set the data type of the array with the A_SETTYPE instruction, and this instruction does not support the operation of BOOL type arrays.

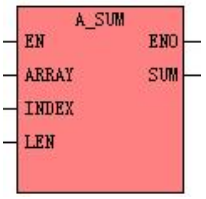
This instruction is used to average the consecutive LEN elements starting from INDEX in the array numbered ARRAY, and store the average value in the memory address specified by AVE.

• LDFormat instruction description

If EN is 1, the instruction executes. If EN is 0, the instruction is not scanned and will not be executed.

6.9.2.11 A_SUM

	Name	Instruction format	Applicable products

LD	A_SUM		☑ K209M ☑ KS101M ☑ K6

Parameter	Input/Output	Datatype	Value range	Memory area allowed
ARRAY	Input	INT	0-15	I、Q、V、M、L、constant
INDEX	Input	INT	0-1023	I、Q、V、M、L、constant
LEN	Input	INT	1-1024	I、Q、V、M、L、constant
SUM	Output	BOOL, BYTE, WORD,DWORD, INT,DINT, REAL	----	V、M、L

Note: ARRAY, INDEX, LEN must be both constants or variables at the same time! Before using this instruction, you must set the data type of the array with the A_SETTYPE instruction, and this instruction does not support the operation of BOOL type arrays.

For the specific usage instructions of each parameter, see the following table:

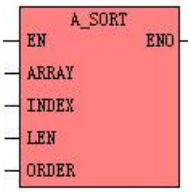
Parameter	Function
EN	enable terminal. If EN is 1, the instruction is enabled and execution is allowed.
ARRAY	Array number to use, in the range 0-15
INDEX	The starting index address of the object to be accessed in the array, range 0-1023
LEN	Number of array elements for data operations, range 1-1024
SUM	The memory address where the sum value obtained by the operation is stored

This instruction is used to sum the consecutive LEN elements starting from INDEX in the array numbered ARRAY, and store the calculation result in the memory address specified by SUM

• LDFormat instruction description

If EN is 1, the instruction executes. If EN is 0, the instruction is not scanned and will not be executed.

6.9.2.12 A_SORT（Sorts the data in the specified range in the array）

	Name	Instruction format	Applicable products
LD	A_SORT		☑ K209M ☑ KS101M ☑ K6

Parameter	Input/Output	Datatype	Value range	Memory area allowed
ARRAY	Input	INT	0-15	I、Q、V、M、L、constant
INDEX	Input	INT	0-1023	I、Q、V、M、L、constant
LEN	Input	INT	1-1024	I、Q、V、M、L、constant
ORDER	Input	INT	升序 1 降序 2	I、Q、V、M、L、constant

For the specific usage instructions of each parameter, see the following table:

Parameter	Function
EN	enable terminal. If EN is 1, the instruction is enabled and execution is allowed.
ARRAY	Array number to use, in the range 0-15
INDEX	The starting index address of the object to be accessed in the array, range 0-1023
LEN	Number of array elements for data operations, range 1-1024
ORDER	The order in which the data is sorted, 1 is ascending, 2 is descending

Note: ARRAY, INDEX, LEN must be both constants or variables at the same time! Before using this instruction, you must set the data type of the array with the A_SETTYPE instruction!

This instruction is used to sort the consecutive LEN elements starting from INDEX in the array numbered ARRAY. The ORDER parameter value indicates ascending order (from small to large) or descending order (from large to small).

• LDFormat instruction description

If EN is 1, the instruction executes. If EN is 0, the instruction is not scanned and will not be executed.