

FUN 72 TP4	Convenient instruction proper to FB-2AJ(K)4/FB-2AH(T)4 temperature module						FUN 72 TP4																																																													
<div>Execution control — EN</div> <div>72.TP4</div> <div><div>Tp : Pl : Sm : Ym : AR : TR : WR :</div><div>ERR — parameter error ALM — sensor line broken</div></div> <div><div>Tp : Type of sensor</div><div>=0, K-type thermocouple =1, J-type thermocouple =2, PT-100 RTD =3, PT-1000 RTD =4, PT-100 (FB-2AH4-3; Up to 286℃ ) =5, PT-1000 (FB-2AT4-3; Up to 286℃ )</div><div>Pl : Setting of polarity and span</div><div>=0 , 0~10V (Unipolar) =1 , 0~5V (Unipolar) =2 , -10~10V (Bipolar) =3 , - 5~5V (Bipolar)</div><div>Unipolar: U/B jumper set at U Bipolar: U/B jumper set at B Span : 5V/10V jumper setting</div><div>Sm : Starting point of temperature measurement of this module. Sm=0 , 4 , 8……… , 28</div><div>Ym : Starting address of discrete output of this module for multiplexing temperature input; it takes 8 points. When expansion module with discrete output will be installed after the temperature module, the discrete output address of which must be added 8.</div><div>AR : Address of analog input for temperature measurement of this module; which is the 3<sup>rd</sup> analog input. When expansion module with analog input will be installed after the temperature module, the analog address of which must be added 3.</div><div>TR : Starting register of the engineering value of temperature measurement, 4 registers in total.</div><div>WR : Starting of working register for this instruction. It takes 8 registers and can't be repeated in using.</div></div> <table><tr><td rowspan="2">Ope- rand</td><td>Y</td><td>HR</td><td>IR</td><td>ROR</td><td>DR</td><td>K</td></tr><tr><td>Y0   Y255</td><td>R0   R3839</td><td>R3840   R3903</td><td>R5000   R8071</td><td>D0   D3071</td><td></td></tr><tr><td>Tp</td><td></td><td></td><td></td><td></td><td></td><td>0~5</td></tr><tr><td>Pl</td><td></td><td></td><td></td><td></td><td></td><td>0~3</td></tr><tr><td>Sm</td><td></td><td></td><td></td><td></td><td></td><td>n×4 , n=0~7</td></tr><tr><td>Ym</td><td>○</td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>AR</td><td></td><td></td><td>○</td><td></td><td></td><td></td></tr><tr><td>TR</td><td></td><td>○</td><td></td><td>○*</td><td>○</td><td></td></tr><tr><td>WR</td><td></td><td>○</td><td></td><td>○*</td><td>○</td><td></td></tr></table> <div>Note1: FUN72 is the convenient instruction dedicated for the multiplexing temperature modules: FB-2AJ4, FB-2AK4, FB-2AH4 and FB-2AT4; each module can perform 4 points of temperature measurement and 2 points of general purpose analog input.</div> <div>Note2: If only temperature measurement is required, each module must have a corresponding FUN72 instruction to get the engineering value of measurement.</div> <div>Note3: If temperature control is required, it must employ the FUN73 instruction to perform the temperature measurement and the PID temperature control.</div> <div>Note4: The FB series PLC can connect up to 8 modules of FB-2AJ(K)4/FB-2AH(T)4, and can perform 32 points of temperature measurement and PID temperature control at the most.</div> <div>Function guide and notifications</div> <div>FB-2AJ(K)4/FB-2AH(T)4 multiplexing temperature module occupies 3 points of analog input address and 8 points of discrete output address in physical, more detail as followings:</div> <div><div>● FB-2AJ4 provides 2 points of general purpose analog inputs (1<sup>st</sup> and 2<sup>nd</sup> analog input) and 4 points of J-type thermocouple inputs for temperature measurement (With the combination of 3<sup>rd</sup> analog input and 8 points of discrete output making 4 points of temperature measurement).</div><div>● FB-2AK4 provides 2 points of general purpose analog inputs (1<sup>st</sup> and 2<sup>nd</sup> analog input) and 4 points of K-type thermocouple inputs for temperature measurement (With the combination of 3<sup>rd</sup> analog input and 8 points of discrete output making 4 points of temperature measurement).</div><div>● FB-2AH4 provides 2 points of general purpose analog inputs (1<sup>st</sup> and 2<sup>nd</sup> analog input) and 4 points of 3-lines PT-100 RTD inputs for temperature measurement (With the combination of 3<sup>rd</sup> analog input and 8 points of discrete output making 4 points of temperature measurement).</div><div>● FB-2AT4 provides 2 points of general purpose analog inputs (1<sup>st</sup> and 2<sup>nd</sup> analog input) and 4 points of 3-lines PT-1000 RTD inputs for temperature measurement (With the combination of 3<sup>rd</sup> analog input and 8 points of discrete output making 4 points of temperature measurement).</div></div>							Ope- rand	Y	HR	IR	ROR	DR	K	Y0   Y255	R0   R3839	R3840   R3903	R5000   R8071	D0   D3071		Tp						0~5	Pl						0~3	Sm						n×4 , n=0~7	Ym	○						AR			○				TR		○		○*	○		WR		○		○*	○	
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	<ul style="list-style-type: none"> <li>● The selection of input span of FB-2AJ(K)4 temperature module can be 5V (500°C) (when jumper setting at the position of 5V) or 10V (1000°C)(when jumper setting at the position of 10V); the input polarity can be set as unipolar (U/B jumper setting at U) or bipolar (U/B jumper setting at B):  When setting at 10V(1000°C) and unipolar,  the range of measurement is 0°C~750°C/32°F ~ 1382°F (J-type) or  0°C~900°C/32°F ~ 1652°F (K-type)  When setting at 5V(500°C) and unipolar,  the range of measurement is 0°C~420°C/32°F ~ 788°F (J-type) or  0°C~450°C/32°F ~ 842°F (K-type)  When setting at 10V(1000°C) and bipolar,  the range of measurement is -200°C~750°C/-328°F ~ 1382°F (J-type) or  -200°C~900°C/-328°F ~ 1652°F (K-type)  When setting at 5V(500°C) and bipolar,  the range of measurement is -200°C~420°C/-328°F ~ 788°F (J-type) or  -200°C~450°C/-328°F ~ 842°F (K-type)</li> <li>● The selection of input span of FB-2AH(T)4 temperature module can be 5V (when jumper setting at the position of 5V) or 10V (when jumper setting at the position of 10V); the input polarity is fixed for bipolar :  When setting at 10V,  the range of measurement of FB-2AH(T)4 : -49.8°C~146.6°C/-57.6°F ~ 295.9°F (DIN) or  -48.9°C~143.9°C/-56.0°F ~ 291.0°F (JIS)  the range of measurement of FB-2AH(T)4-3 : -49.1°C~286.2°C/-56.4°F ~ 547.2°F (DIN) or  -48.2°C~281.0°C/-54.8°F ~ 537.8°F (JIS)  When setting at 5V,  the range of measurement of FB-2AH(T)4 : -12.3°C~83.6°C/9.9°F ~ 182.5°F (DIN) or  -12.0°C~82.1°C/10.4°F ~ 179.8°F (JIS)  the range of measurement of FB-2AH(T)4-3 : 5.5°C~164.5°C/41.9°F ~ 328.1°F (DIN) or  5.4°C~161.5°C/41.7°F ~ 322.7°F (JIS)</li> <li>● FB-2AJ(K)4/FB-2AH(T)4 multiplexing temperature module occupies 3 points of analog input address and 8 points of discrete output address in physical; <ul style="list-style-type: none"> <li>• when expansion module with analog input will be installed after this kind of module, the analog address of which must be added 3;</li> <li>• when expansion module with discrete output will be installed after this kind of module, the discrete output address of which must be added 8.</li> </ul> </li> <li>● Modules FB-2AJ(K)4/FB-2AH(T)4 can't be used together with module FB-8AD or FB-4AJ(K)××.</li> <li>● For the selection of thermocouple, K-type thermocouple is recommended.</li> <li>● It is recommended to select 0~5V for the span and polarity of input if it meets the requirement.</li> <li>● Connect the "FG" terminal with the shielding of thermocouple if it is with for better measurement.</li> <li>● The "G⊕" terminal must be connected to the safty earth ground of the power system.</li> </ul>	

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<div data-bbox="188 331 738 365" style="border: 1px solid black; padding: 2px;">User guide for convenient instruction FUN72</div> <p data-bbox="188 383 544 409">FB-2AJ(K)4 temperature module:</p> <ul data-bbox="225 421 1414 607" style="list-style-type: none"> <li>● When execution control “EN”=1, this instruction will perform multiplexing temperature measurement and store the primitive value into R3968(TP0)~R3971(TP3) or R3972(TP4)~3975(TP7),...or R3996(TP28)~R3999(TP31); the value falls in 0~4095(unipolar) or -2048~2047 (bipolar). And then base on the setting of temperature sensor (Tp), input span and polarity (PI) of the temperature module to scale the primitive values to engineering values and store them to temperature measurement registers (TR+0 as the 1<sup>st</sup> point, ..., TR+3 as the 4<sup>th</sup> point).</li> </ul> <p data-bbox="188 613 544 640">FB-2AH(T)4 temperature module:</p> <ul data-bbox="225 645 1414 1637" style="list-style-type: none"> <li>● When execution control “EN”=1, this instruction will perform multiplexing temperature measurement and base on the setting of temperature sensor (Tp), input span and polarity (PI) of the temperature module to scale the primitive values to engineering values and store them to temperature measurement registers (TR+0 as the 1<sup>st</sup> point, ..., TR+3 as the 4<sup>th</sup> point). Then scale the engineering values by the range of 0~4095 and store them into R3968(TP0)~R3971(TP3) or R3972(TP4)~3975(TP7),...or R3996(TP28)~R3999(TP31); the value falls in 0~4095.</li> <li>● When the setting of Tp, PI, Sm comes error, this instruction will not be performed and the output indication “ERR” will be ON.</li> <li>● When the sensor is K-type thermocouple (it needs FB-2AK4 module): <ol data-bbox="261 949 1414 1182" style="list-style-type: none"> <li>1.As the setting of input span and polarity is 0~10V, if the display value is greater than 900°C or 1700°F, it means the line broken of the thermocouple and the output indication “ALM” will be ON.</li> <li>2.As the setting of input span and polarity is 0~5V, if the display value is greater than 450°C or 870°F, it means the line broken of the thermocouple and the output indication “ALM” will be ON.</li> <li>3.As the setting of input span and polarity is -10~10V, if the display value is greater than 900°C or 1700°F, it means the line broken of the thermocouple and the output indication “ALM” will be ON.</li> <li>4.As the setting of input span and polarity is -5~5V, if the display value is greater than 450°C or 870°F, it means the line broken of the thermocouple and the output indication “ALM” will be ON.</li> </ol> </li> <li>● When the sensor is J-type thermocouple (it needs FB-2AJ4 module): <ol data-bbox="261 1234 1414 1467" style="list-style-type: none"> <li>1.As the setting of input span and polarity is 0~10V, if the display value is greater than 900°C or 1700°F, it means the line broken of the thermocouple and the output indication “ALM” will be ON.</li> <li>2.As the setting of input span and polarity is 0~5V, if the display value is greater than 450°C or 870°F, it means the line broken of the thermocouple and the output indication “ALM” will be ON.</li> <li>3.As the setting of input span and polarity is -10~10V, if the display value is greater than 900°C or 1700°F, it means the line broken of the thermocouple and the output indication “ALM” will be ON.</li> <li>4.As the setting of input span and polarity is -5~5V, if the display value is greater than 450°C or 870°F, it means the line broken of the thermocouple and the output indication “ALM” will be ON.</li> </ol> </li> <li>● When the sensor is RTD type of PT-100 (it needs FB-2AH4) or PT-1000 (it needs FB-2AT4): <ol data-bbox="261 1518 1414 1637" style="list-style-type: none"> <li>1. As the setting of input span is -10~10V, if the display value is greater than 900.0°C or 900.0°F, it means the line broken of the sensor and the output indication “ALM” will be ON.</li> <li>2. As the setting of input span is -5~5V, if the display value is greater than 900.0°C or 900.0°F, it means the line broken of the sensor and the output indication “ALM” will be ON.</li> </ol> </li> </ul> <p data-bbox="233 1680 1414 1738" style="margin-top: 20px;">Note: When there exists the line broken of the sensor, it can be told from the content of WR+0 working register, which tells the input point(s) of line broken.</p>		

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	<ul style="list-style-type: none"> <li>● Sm : Starting point of temperature measurement of this module. It must be the multiple of 4 , <math>0 \leq Sm \leq 28</math>.</li> <li>● Ym : Starting address of discrete output of this module for multiplexing temperature input; it takes 8 points of discrete output.</li> <li>● AR : Address of analog input (3<sup>rd</sup>) for temperature measurement of this module.</li> <li>● TR : Starting register of the engineering value of temperature measurement, 4 registers in total. TR+0 stores the 1<sup>st</sup> temperature,..., TR+3 stores the 4<sup>th</sup> temperature.</li> <li>● WR : Starting of working register for this instruction. It takes 8 registers and can't be repeated in using. The content of WR+0 register indicates the status of the sensor which is line broken or not. Bit definition of WR+0 explained as follows: Bit0 =1 indicating that the 1<sup>st</sup> point of sensor is line broken; ...; Bit3=1 indicating that the 4<sup>th</sup> point of sensor is line broken. Registers WR+2~WR+7 are used by this instruction.</li> <li>● If it only needs to measure temperature, there should be a corresponding FUN72 instruction each for every temperature module to perform the measurement.</li> <li>● No matter the FUN72 is placed in main program or in sub-program, and whether the execution control "EN"=0 or 1, this instruction must be executed every scan.</li> </ul> <div style="border: 1px solid black; padding: 2px; margin: 10px 0;"> <b>Explanation of specific registers for FUN72</b> </div> <ul style="list-style-type: none"> <li>● R3968~R3999 : Registers storing the primitive temperature value. R3968 storing the 1<sup>st</sup> point, R3969 storing the 2<sup>nd</sup> point, etc. and R3999 storing the 32<sup>th</sup> point. The value is from 0~4095 (unipolar) or -2048~2047 (bipolar).</li> <li>● R4009 : Lower byte=1, temperature in Fahrenheit unit (°F) ; =Other values, temperature in Centigrade unit (°C)</li> <li>● R4014 : Time interval between the measurement points while multiplexing. Which the user can set up. The unit is in mS and the default value is 500; it means it needs 500 mS to measure one point of temperature. This means the update rate of the temperature is 2 seconds (500mS×4=2000mS) When the value of R4014 is 250, it means it needs 250mS to measure one point of temperature. The update rate of the temperature is 1 second (250mS×4=1000mS) When the value of R4014 is 1000, it means it needs 1000mS to measure one point of temperature. The update rate of the temperature is 4 seconds (1000mS×4=4000mS) When the value of R4014 is 2000, it means it needs 2000mS to measure one point of temperature. The update rate of the temperature is 8 seconds (2000mS×4=8000mS)</li> <li>● R4015 : Times for the average of measurement, which can be set by the user. =0, no average; every acquired value is the measured value (default) =1, average of 2 times; the average on the acquired 2 times of values is the measured value. =2, average of 4 times; the average on the acquired 4 times of values is the measured value. =3, average of 8 times; the average on the acquired 8 times of values is the measured value. =4, average of 16 times; the average on the acquired 16 times of values is the measured value.</li> <li>● R4016 : The factor for linear scaling to calculate the engineering value of K-type thermocouple while in positive temperature; the default value is 248. The expression for engineering value is as follows: Engineering value = (Primitive temperature value ×R4016) /1024 (Unipolar). Engineering value = (Primitive temperature value ×2×R4016) /1024 (Bipolar). When there is a slight difference in measurement result between the standard meter and the FB-PLC's temperature module, if the user would like to use the value acquired by standard meter for correction, the user can tune the value of R4016 to get a better result in temperature measurement. This register provides fine tuning for positive temperature.</li> <li>● R4017 : The factor for linear scaling to calculate the engineering value of K-type thermocouple while in negative temperature; the default value is 286. The expression for engineering value is as follows: Engineering value = (Primitive temperature value ×R4017) /1024 (-5~5V). Engineering value = (Primitive temperature value ×2×R4017) /1024 (-10~10V). When there is a slight difference in measurement result between the standard meter and the FB-PLC's temperature module, if the user would like to use the value acquired by standard meter for correction, the user can tune the value of R4017 to get a better result in temperature measurement. This register provides fine tuning for negative temperature.</li> </ul>	

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	<ul style="list-style-type: none"> <li>● R4018 : The factor for linear scaling to calculate the engineering value of J-type thermocouple while in positive temperature; the default value is 240. The expression for engineering value is as follows: Engineering value = (Primitive temperature value × R4018) / 1024 (Unipolar). Engineering value = (Primitive temperature value × 2 × R4018) / 1024 (Bipolar). When there is a slight difference in measurement result between the standard meter and the FB-PLC's temperature module, if the user would like to use the value acquired by standard meter for correction, the user can tune the value of R4018 to get a better result in temperature measurement. This register provides fine tuning for positive temperature.</li> <li>● R4019 : The factor for linear scaling to calculate the engineering value of J-type thermocouple while in negative temperature; the default value is 280. The expression for engineering value is as follows: Engineering value = (Primitive temperature value × R4019) / 1024 (–5~5V). Engineering value = (Primitive temperature value × 2 × R4019) / 1024 (–10~10V). When there is a slight difference in measurement result between the standard meter and the FB-PLC's temperature module, if the user would like to use the value acquired by standard meter for correction, the user can tune the value of R4019 to get a better result in temperature measurement. This register provides fine tuning for negative temperature.</li> <li>● R4020 : High Byte of R4020 to tell the alpha value of RTD, α=0, α=0.00385 (DIN) α=1, α=0.00392 (JIS) : Low Byte of R4020 to tell where the registers storing the wire resistance for compensation, =1, the wire resistance for compensation for 3-wires RTD input storing in registers Rxxxx =2, the wire resistance for compensation for 3-wires RTD input storing in registers Dxxxx The starting address of above mentioned registers is storing in R4021. The default of R4020 is 0001H.</li> <li>● R4021 : Storing the starting address of the registers to store the wire resistance for compensation for 3-wires RTD input; the default of R4021 is 8000, it means the starting register to store the wire resistance for compensation is R8000 by default. The unit of the resistance is 0.1Ω. While in long distance measurement and the accuracy will be affected by the wire resistance of the connection between the RTD sensor and temperature module, under such situation, the user has to measure the wire resistance of each loop and input them to the registers mentioned above; otherwise, forget these.</li> <li>● R4022 : The factor for linear scaling to calculate the engineering value of PT-100 ; the default value is 1024 The expression for engineering value is as follows: Engineering value = (Primitive temperature value × R4022) / 1024</li> <li>● R4023 : The factor for linear scaling to calculate the engineering value of PT-1000 ; the default is 1024 The expression for engineering value is as follows: Engineering value = (Primitive temperature value × R4023) / 1024 When it needs to do the calibration between the standard meter and the FB-PLC's temperature module, the user can tune the value of R4022 or R4023 to get a better result of measurement.</li> <li>● R4010 : Each bit of R4010 to tell the status of the sensor's installation. Bit0=1 means that 1<sup>st</sup> point of temperature sensor is installed. Bit1=1 means that 2<sup>nd</sup> point of temperature sensor is installed. . . Bit15=1 means that 16<sup>th</sup> point of temperature sensor is installed.(The default of R4010 is FFFFH)</li> <li>● R4011 : Each bit of R4011 to tell the status of the sensor's installation. Bit0=1 means that 17<sup>th</sup> point of temperature sensor is installed. Bit1=1 means that 18<sup>th</sup> point of temperature sensor is installed. . . Bit15=1 means that 32<sup>th</sup> point of temperature sensor is installed. (The default of R4011 is FFFFH)</li> <li>● When the temperature sensor is installed (the corresponding bit of R4010 or R4011 must be 1), the system will perform the line broken detection to the sensor. If there is line broken happened to the sensor, there will have the warning and the line broken value will be displayed.</li> <li>● When the temperature sensor is not installed (the corresponding bit of R4010 or R4011 must be 0), the system won't perform the line broken detection to the sensor and there will not have the warning; the temperature value will be displayed as 0.</li> <li>● Depends on the sensor's installation, the ladder program may control the corresponding bit of R4010 and R4011 to tell FUN72 to perform or not to perform the line broken detection.</li> </ul>	