

# FMA120 I/O settings

[Main Page](#) > [EOL Products](#) > [FMA120](#) > [FMA120 Configuration](#) > **FMA120 I/O settings**

FMA120 sends SMS event message when a configured I/O property enters and/or exits its configured High/Low boundaries or Hysteresis event generation is chosen (Monitoring does not generate event, so SMS event could not be configured).

System	I/O							
Records	Property Input	Enabled	Priority	Low Level	High Level	Units	Generate Event	Averaging Constant
	Digital input 1	<input checked="" type="checkbox"/>	High	0	1		On Both	10
GSM	Digital input 2	<input type="checkbox"/>	Disab	0	0		Monitoring	10
DataAcquisitionModes	Digital input 3	<input type="checkbox"/>	Disab	0	0		Monitoring	10
Features	Digital input 4	<input type="checkbox"/>	Disab	0	0		Monitoring	10
	Analog input 1	<input type="checkbox"/>	Disab	0	0		Monitoring	2
IO	Digital output 1	<input type="checkbox"/>	Disab	0	0		Monitoring	10
LVCAN	Digital output 2	<input type="checkbox"/>	Disab	0	0		Monitoring	10
	GNSS PDOP	<input type="checkbox"/>	Disab	0	0		Monitoring	10
	GNSS HDOP	<input type="checkbox"/>	Disab	0	0		Monitoring	10

Every IO element SMS event can be configured to send individual message to different numbers.

System	SMS Events			
Records	Description	Enable	SMS Number	SMS Text
	Digital input 1	<input checked="" type="checkbox"/>	37061234567	Digital Input 1
GSM	Digital input 2	<input type="checkbox"/>	37061234567	Digital Input 2
> GPRS	Digital input 3	<input type="checkbox"/>	37061234567	Digital Input 3
> SMS	Digital input 4	<input type="checkbox"/>	37061234567	Digital Input 4
> SMS Events	Analog input 1	<input type="checkbox"/>	37061234567	Analog Input 1
> Operator list	Digital output 1	<input type="checkbox"/>	37061234567	Digital Output 1
DataAcquisitionModes	Digital output 2	<input type="checkbox"/>	37061234567	Digital Output 2
	GNSS PDOP	<input type="checkbox"/>	37061234567	GNSS PDOP
	GNSS HDOP	<input type="checkbox"/>	37061234567	GNSS HDOP
	External voltage	<input type="checkbox"/>	37061234567	External Voltage

When no I/O element is enabled, AVL packet comes with GNSS information only. After enabling I/O element(s) AVL packet along with GNSS information contains current value(s) of enabled I/O element.

### Permanent I/O elements (are always sent to server if enabled)

No.	Property Name	Description
01	Digital Input Status 1	Logic: 0 / 1
02	Digital Input Status 2	Logic: 0 / 1
03	Digital Input Status 3	Logic: 0 / 1
04	Analog Input 1	Voltage: mV, 0 - 30 V
05	Digital Output 1	Logic: 0 / 1

<b>06</b>	Digital Output 2	Logic: 0 / 1
<b>07</b>	GNSS PDOP	Probability * 10; 0-500
<b>08</b>	GNSS HDOP	Probability * 10; 0-500
<b>09</b>	External Voltage	Voltage: mV, 0 - 30 V
<b>10</b>	GNSS Status	States: 0 - off state (when GPS module is off) 1 - Reserved 2 - GPS ready (antenna is working, but with no GPS fix) 3 - GPS working (antenna is working and has GPS fix) 4 - GPS sleep (when device is in GPS sleep mode) 5 - Overcurrent (The only condition to get value 5, then antenna is damaged and short circuit)
<b>11</b>	Movement Sensor	0 - not moving, 1 - moving.
<b>12</b>	Trip distance	Distance between two records: m
<b>13</b>	GSM Operator	Currently used GSM Operator code
<b>14</b>	Speed (Km/h)	Value in km/h, 0 - xxx km/h
<b>15</b>	iButton ID	iButton ID number
<b>16</b>	Mode	0 - home on stop, 1 - home on move, 2 - roaming on stop, 3 - roaming on move, 4 - unknown on stop, 5 - unknown on move
<b>17</b>	GSM Signal	GSM signal level value in scale 1 - 5
<b>18</b>	Deep Sleep	0 - not deep sleep mode, 1 - deep sleep mode
<b>19</b>	Cell ID	GSM base station ID
<b>20</b>	Area Code	Location Area code (LAC), it depends on GSM operator. It provides unique number which assigned to a set of base GSM stations. Max value: 65536
<b>21</b>	Dallas Temperature 1	10 * Degrees (°C), -55 - +115, if 3000 - Dallas error
<b>22</b>	Battery Voltage	Voltage: mV
<b>23</b>	Battery Charging Current	Current: mA
<b>24</b>	Ignition	Ignition status indication. Logic: 0 / 1
<b>25</b>	Total distance	Distance which device has been traveled with ignition ON: m
<b>26</b>	Reserved IO 1	Reserved for future use
<b>27</b>	Reserved IO 2	Reserved for future use
<b>28</b>	Dallas Temperature 2	10 * Degrees (°C), -55 - +115, if 3000 - Dallas error
<b>29</b>	Dallas Temperature 3	10 * Degrees (°C), -55 - +115, if 3000 - Dallas error
<b>30</b>	Dallas Temperature 4	10 * Degrees (°C), -55 - +115, if 3000 - Dallas error
<b>31</b>	Dallas temperature ID1	1st connected dallas temperature sensor ID
<b>32</b>	Dallas temperature ID2	2nd connected dallas temperature sensor ID
<b>33</b>	Dallas temperature ID3	3rd connected dallas temperature sensor ID
<b>34</b>	Dallas temperature ID4	4rd connected dallas temperature sensor ID

**Eventual I/O elements (generate and send record to server only if appropriate conditions are met)**

<b>35</b>	Geofence zone 01	Event: 0 - target left zone, 1 - target entered zone
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<b>36</b> Geofence zone 02	Event: 0 - target left zone, 1 - target entered zone
<b>37</b> Geofence zone 03	Event: 0 - target left zone, 1 - target entered zone
<b>38</b> Geofence zone 04	Event: 0 - target left zone, 1 - target entered zone
<b>39</b> Geofence zone 05	Event: 0 - target left zone, 1 - target entered zone
<b>40</b> Auto Geofence	Event: 0 - target left zone, 1 - target entered zone
<b>41</b> Trip	1 - trip start, 0 - trip stop
<b>42</b> Immobilizer	1 - iButton connected
<b>43</b> Authorized driving	1 - authorized iButton connected
<b>44</b> Green driving type	1 - harsh acceleration, 2 - harsh braking, 3 - harsh cornering
<b>45</b> Green driving value	Depending on green driving type: if harsh acceleration or braking - g*100 (value 123 -> 1.23g), if harsh cornering - degrees (value in radians)
<b>46</b> Over Speeding	At over speeding start km/h, at over speeding end km/h
<b>47</b> LVCAN Speed	Value in km/h, 0 - 250 km/h
<b>48</b> LVCAN Accelerator pedal position	Value range: 0-100 %
<b>49</b> LVCAN Total fuel used	Value range: 0- 99999999 liters* "Total Fuel Used" is sent to server multiplied by 10. Example: if value was 150.5 liters, "1505" will be sent to server.
<b>50</b> LVCAN Fuel level (liters)	Value range: 0-100 liters
<b>51</b> LVCAN Engine RPM	Value range: 0-8200 rpm
<b>52</b> LVCAN Vehicle distance	Value range: 0-2145000000 meters
<b>53</b> LVCAN Fuel level (proc.)	Value range: 0-100 %
<b>54</b> LVCAN Program number	Value range: 0-999
<b>55</b> LVC ModuleID	Value range: 0-max
<b>56</b> LVC Engine Work Time	Value range: 0-4294967295
<b>57</b> LVC Engine Work Time (counted)	Value range: 0-4294967295
<b>58</b> LVC Total Mileage (counted)	Value range: 0-4294967295
<b>59</b> LVC Fuel Consumed (counted)	Value range: 0-4294967295
<b>60</b> LVC Fuel Rate	Value range: 0-4294967295
<b>61</b> LVC AdBlue Level (percent)	Value range: 0-4294967295
<b>62</b> LVC AdBlue Level (liters)	Value range: 0-255
<b>63</b> LVC Engine Load	Value range: 0-65535
<b>64</b> LVC Engine Temperature	Value range: 0-65535
<b>65</b> LVC Axle 1 Load	Value range: 0-255
<b>66</b> LVC Axle 2 Load	Value range: 0-65535
<b>67</b> LVC Axle 3 Load	Value range: 0-65535
<b>68</b> LVC Axle 4 Load	Value range: 0-255
<b>69</b> LVC Axle 5 Load	Value range: 0-65535
<b>70</b> LVC Control State Flags	Value range: 0-255
<b>71</b> LVC Agricultural Machinery Flags	Value range: 0-255
<b>72</b> LVC Harvesting Time	Value range: 0-65535
<b>73</b> LVC Area of Harvest	Value range: 0-65535

<b>74</b>	LVC Mowing Efficiency	Value range: 0-65535
<b>75</b>	LVC Grain Mown Volume	Value range: 0-65535
<b>76</b>	LVC Grain Moisture	Value range: 0-65535
<b>77</b>	LVC Harvesting Drum RPM	Value range: 0-4294967295
<b>78</b>	LVC Gap Under Harvesting Drum	Value range: 0-max
<b>79</b>	LVC Security State Flags	Value range: 0-4294967295
<b>80</b>	LVC Tacho Total Vehicle Distance	Value range: 0-4294967295
<b>81</b>	LVC Trip Distance	Value range: 0-4294967295
<b>82</b>	LVC Tacho Vehicle Speed	Value range: 0-4294967295
<b>83</b>	LVC Tacho Driver Card Presence	Value range: 0-65535
<b>84</b>	LVC Driver1 States	Value range: 0-65535
<b>85</b>	LVC Driver2 States	Value range: 0-255
<b>86</b>	LVC Driver1 Continuous Driving Time	Value range: 0-max
<b>87</b>	LVC Driver2 Continuous Driving Time	Value range: 0-4294967295
<b>88</b>	LVC Driver1 Cumulative Break Time	Value range: 0-4294967295
<b>89</b>	LVC Driver2 Cumulative Break Time	Value range: 0-65535
<b>90</b>	LVC Driver1 Duration Of Selected Action	Value range: 0-255
<b>91</b>	LVC Driver2 Duration Of Selected Action	Value range: 0-255
<b>92</b>	LVC Driver1 Cumulative Driving Time	Value range: 0-255
<b>93</b>	LVC Driver2 Cumulative Driving Time	Value range: 0-65535
<b>94</b>	LVC Driver1 ID High	Value range: 0-65535
<b>95</b>	LVC Driver1 ID Low	Value range: 0-65535
<b>96</b>	LVC Driver2 ID High	Value range: 0-65535
<b>97</b>	LVC Driver2 ID Low	Value range: 0-65535
<b>98</b>	LVC Battery Temperature	Value range: 0-65535
<b>99</b>	LVC Battery Level (percent)	Value range: 0-65535

Note: There are two types of operations with Permanent I/O elements: simple monitoring and event generating. Monitoring method is used when current I/O information needed with regular GNSS coordinates. Event generating method is used when additional AVL packet is needed when current value of I/O exceeds predefined High and Low levels. I/O settings allow defining I/O event criteria.

System	I/O						
Records	Property Input	<input type="checkbox"/> Enabled	Priority	Low Level	High Level	Generate Event	Averaging Constant
GSM	GNSS PDOP	<input type="checkbox"/>	Disabl	0	0	Monitoring	10
	GNSS HDOP	<input type="checkbox"/>	Disabl	0	0	Monitoring	10
DataAcquisitionModes	External voltage	<input type="checkbox"/>	Disabl	10000	30000	On Exit	10
Features	GNSS power	<input type="checkbox"/>	Disabl	0	0	Monitoring	
	Movement sensor	<input type="checkbox"/>	Disabl	0	0	Monitoring	10
IO	Odometer value	<input type="checkbox"/>	Disabl	0	0	Monitoring	
	GSM operator	<input type="checkbox"/>	Disabl	0	0	Monitoring	
LVCAN	Speed (km/h)	<input type="checkbox"/>	Disabl	0	0	Monitoring	60
	iButton ID	<input type="checkbox"/>	Disabl	0	5	On Entrance	10
	Mode	<input type="checkbox"/>	Disabl	0	0	Monitoring	

Enabled or disabled field - allows enabling I/O element so it is added to the data packet and is sent to the server. By default all I/O element are disabled and FMA120 records only GNSS coordinates.

Priority (AVL packet priority) can be low, high or panic. Regular packets are sent as Low priority records. When low priority event is triggered, FMA120 makes additional record with indication that the reason for that was I/O element change. When High priority is selected, module makes additional record with high priority flag and sends event packet immediately to the server by GPRS. Panic priority triggers same actions as high priority, but if GPRS fails, it sends AVL packet using SMS mode if SMS is **enabled in SMS settings**.

High and Low levels - define I/O value range. If I/O value enters or exits this range, FMA120 generates event. "Generate event" parameter defines when to generate event - when value enters defined range, exits it or both.

Averaging constant - it is an I/O event delay parameter. In some applications there is no need to generate events on every I/O range enter/exit immediately. Sometimes it is necessary to wait some time interval before event generating. Averaging constant allows setting I/O event delay (averaging). If I/O value is entering or leaving predefined range, it must have same value for Averaging constant time. 1 Averaging constant value equals about 30 miliseconds. In Deep Sleep mode there is no Averaging.

Note: Note: I/O element's "Movement sensor" Averaging constant is interpreted as Start Move  Timeout in seconds (from 1 to 59). Start Move Timeout - is a time interval required for movement sensor to be in the moving state, to consider vehicle as moving.

## Monitoring

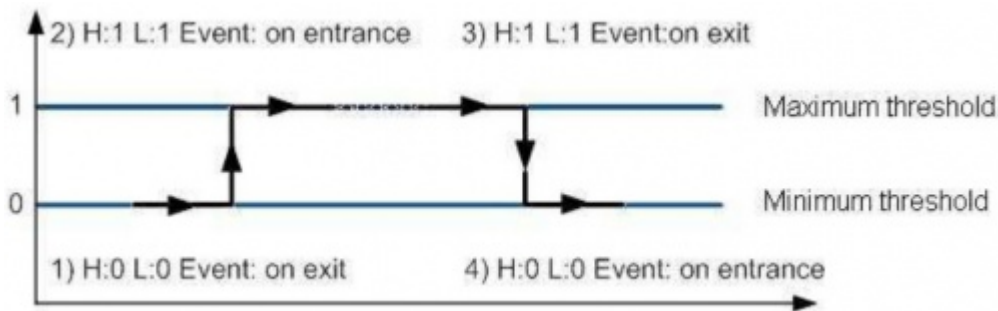
I/O monitoring starts after enabling I/O element and setting up I/O parameters as it is shown below:

System	I/O							
Records	Property Input	<input type="checkbox"/> Enabled	Priority	Low Level	High Level	Units	Generate Event	Averaging Constant
GSM	Digital input 1	<input checked="" type="checkbox"/>	Low	0	1		Monitoring	10
	Digital input 2	<input type="checkbox"/>	Disabl	0	0		Monitoring	10
DataAcquisitionModes	Digital input 3	<input type="checkbox"/>	Disabl	0	0		Monitoring	10
	Digital input 4	<input type="checkbox"/>	Disabl	0	0		Monitoring	10
Features	Analog input 1	<input type="checkbox"/>	Disabl	0	0		Monitoring	2
IO	Digital output 1	<input type="checkbox"/>	Disabl	0	0		Monitoring	10
	Digital output 2	<input type="checkbox"/>	Disabl	0	0		Monitoring	10
LVCAN	GNSS PDOP	<input type="checkbox"/>	Disabl	0	0		Monitoring	10
	GNSS HDOP	<input type="checkbox"/>	Disabl	0	0		Monitoring	10

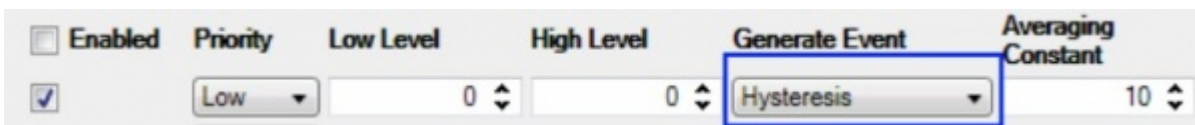
# Event generating

Events happen when the value of enabled I/O intersects thresholds (enter, exit or on both) predefined by High and Low level thresholds. Table below defines all available values of I/O settings.

Setting	Value
Priority	low, high
High level	maximum threshold
Low level	minimum threshold
Generate event	on interval enter, on interval exit, on both enter and exit
Average constant	1 - 2 <sup>32</sup> (4 Bytes)



# Hysteresis



I/O elements can generate events according to hysteresis algorithm. If I/O event operand "Hysteresis" is selected, events will be generated as it is shown in the illustration below (I/O speed is taken as I/O value example):

