

ARF18

Remote control learning process

OVERVIEW	2
HARDWARE INTERFACE	3
NORMAL MODE	5
LEARNING MODE	6
TECHNICAL SPECIFICATIONS	9
REGISTER SUMMARY	9

OVERVIEW

This document describes the functionality of ARF18 receiver digital outputs and the procedure to associate a remote control with one or multiple outputs on ARF7293 and ARF7294 receivers of ARF18 range.

The ARF18 receiver learning procedure is able to configure the system in the following way:

- Any remote control key can drive any of the output of the receiver.
- One or more remote control can drive the same outputs.
- Any remote control key is able to drive from 1 to 4 outputs of the receiver.
- The learning process can be initiated either by switch inputs or by AT command through the serial link.

This document also describes the functionality of the receiver when configured:

- Flip-flop or monostable functionality of digital outputs configurable by switch inputs.
- Transmission through the serial link of each remote control serial number.

Caution: for a keys remote control, some learning combinations are not available; see paragraph "keys learning feature"

HARDWARE INTERFACE

This section describes module input and output used for learning mode control. Pinout may change depending on the reference of the receiver module. Please check the user guide of the receiver.

Pin name	Direction	Description																								
Add/Remove	Input	Logical '1' applied: The "Add/Remove" function is not activated. Logical '0' applied: The "Add/Remove" function is activated																								
Erase	Input	Logical '1' applied: The "Erase" function is not activated. Logical '0' applied: The "Erase" function is activated.																								
Sel0 and Sel1	Input	<p>→ When the module is set in learning mode, ("Add/Remove" or "Erase" set with a logical '0'), "Sel0" and "Sel1" select the output to configure:</p> <table style="margin-left: auto; margin-right: auto; border-collapse: collapse;"> <tr> <td style="padding: 0 10px;">Sel 1</td> <td style="padding: 0 10px;">Sel 0</td> <td style="padding: 0 10px;">Digital output selected</td> </tr> <tr> <td style="text-align: center;">0</td> <td style="text-align: center;">0</td> <td style="text-align: center;">0</td> </tr> <tr> <td style="text-align: center;">0</td> <td style="text-align: center;">1</td> <td style="text-align: center;">1</td> </tr> <tr> <td style="text-align: center;">4</td> <td style="text-align: center;">3</td> <td style="text-align: center;">3</td> </tr> <tr> <td style="text-align: center;">1</td> <td style="text-align: center;">2</td> <td style="text-align: center;">2</td> </tr> <tr> <td style="text-align: center;">0</td> <td style="text-align: center;">1</td> <td style="text-align: center;">1</td> </tr> <tr> <td style="text-align: center;">1</td> <td style="text-align: center;">1</td> <td style="text-align: center;">1</td> </tr> <tr> <td style="text-align: center;">1</td> <td style="text-align: center;">1</td> <td style="text-align: center;">1</td> </tr> </table> <p>→ When the module is not in learning mode, the "Sel0" input selects the kind of functionality of Digital outputs 1 and 2 and "Sel1" selects the functionality for outputs 3 and 4.</p> <ul style="list-style-type: none"> • Logical '0' applied on "Sel0": digital output 1 and 2 in flip-flop mode. • Logical '0' applied on "Sel1": digital output 3 and 4 in flip-flop mode. • Logical '1' applied on "Sel0": digital output 1 and 2 in monostable mode. • Logical '1' applied on "Sel1": digital output 3 and 4 in monostable mode. 	Sel 1	Sel 0	Digital output selected	0	0	0	0	1	1	4	3	3	1	2	2	0	1	1	1	1	1	1	1	1
Sel 1	Sel 0	Digital output selected																								
0	0	0																								
0	1	1																								
4	3	3																								
1	2	2																								
0	1	1																								
1	1	1																								
1	1	1																								

Pin name	Direction	Description
Global	Input	The global input is used to determine if the learning operation is performed for multiple digital outputs or not. → When a logical '0' is applied on "Global": the learning operation is performed for multiple outputs (the "Sel0" and "Sel1" inputs are ignored). The functionality depends on the function selected ("Erase" or "Add/Remove"). → When a logical '1' is applied on "Global": the learning operation only applies to the digital output selected with 'Sel0' and 'Sel1'.
Led	Output	This output is dedicated to drive a LED on the mother board. It is only used during learning process. The default state of this output is a logical '1'. It produces an approximate pulse of 200ms (logical '0') when a new remote control is added on the system, and 2 pulses spaced by a 200ms duration when one or more remote controls are erased from the base.
Digital output 1	Output	This output is one of the four outputs driven by the module when a signal is received from a remote control recorded for this output.
Digital output 2	Output	This output is one of the four outputs driven by the module when a signal is received from a remote control recorded for this output.
Digital output 3	Output	This output is one of the four outputs driven by the module when a signal is received from a remote control recorded for this output.
Digital output 4	Output	This output is one of the four outputs driven by the module when a signal is received from a remote control recorded for this output.

PCB recommendation:

If not used, the learning inputs must be tied as described below:

- "Add/Remove" and "Erase" have to be connected to a logical '1'.
- "Sel0" and "Sel1" have to be connected either to a logical '1' or to a logical '0' depending on how the digital outputs are used (flip-flop or monostable). Even if outputs are not used, "Sel0" and "Sel1" must be connected. In this case a logical '0' or '1' can be applied.
- "Global" has to be connected either to a logical '1' or to a logical '0'.

NORMAL MODE

The remote control authentication is based on the remote control serial number. The number of the key which has been pressed is also used to determine which digital outputs have to be set. When performing the learning procedure, the receiver stores in its database a couple [serial number of the remote control + number of the key] on one side and the output(s) (1 to 4) to drive when this couple is received on the other side.

The learning procedure is only applicable to drive digital outputs. No learning process is required to receive remote control on the serial link. All remote control serial number + key are transferred on the serial link including the couple which drives digital outputs.

When a remote control is received, the following operation is performed:

- The remote control serial number + remote control key are sent on the serial link in ASCII text with the following format: " :<serial number> <key number><CR><LF>" with a serial number value from 0 to 16777215 followed by a space (ASCII code 0x20) and a key number equals to "01" up to "24". The serial number is in decimal format.
- The receiver browses the receiver remote control database for the couple serial number + key received to get the outputs to drive.
- If an entry has been found in the database of the receiver, the corresponding outputs are driven. If the output to drive is output 1 or output 2, the input switch Sel0 is read and used to determine how to drive the output: if the level applied is a logical '0', the output has a flip-flop behaviour. If the level applied is a logical '1', the output behaviour is monostable. Same thing with outputs 3 and 4 / Sel1.

Flip-flop mode:

When an output is used in flip-flop mode, the output state is reversed each time a remote control key that drives this output is pressed.

Monostable mode:

When an output is used in monostable mode, the output is set to logical '1' while the key is pressed by the user. The output is set to logical '0' when the key on the remote control is released.

The receiver runs in normal mode when the "Add/Remove" and "Erase" entry are set to a logical '1' and all AT registers

ATS801=ATS802=ATS803=ATS804=ATS805=0.

LEARNING MODES

The learning modes are entered either applying the appropriate levels on the module inputs (Sel0, Sel1, Global, Add/Remove, Erase) or using the serial link using AT commands.

For this section, we will suppose that a set of switches is connected to the module and the "ON" position applies a logical '0' on the module entry. We also suppose that a LED is connected on the "LED" output of the module.

Two commands are available:

→ **Add/Remove**: when the logical level on this input is set to "0", it allows adding or removing the couple remote control serial number + key from the database of the receiver for a selected output.

For instance, to link a couple [serial number of a remote control + number of a key] to an output, you have to: select the output through "sel0" and "sel1", set "Add/Remove" to "0" and, then, press the key of the remote control. If this link already exists in the receiver database, this operation will remove it from the database.

→ **Erase**: when level '0' is applied on this input it will erase all couples [serial number + key] from the database for a output selected with pins "sel0" and "sel1". After this operation, the selected output is no more driven by any remote control. For security reasons, this operation is performed after the reception of a valid frame from any remote control.

Note: Combination of a command with "Global" pin.

Activating "Global" input (level "0" applied) modifies the behaviour of the commands Add/remove and Erase as follow :

- Add/Remove command:

If the remote control pressed (key is ignored) drives at least one output of the receiver, all the associations for this remote control are suppressed, i.e. this remote control does no more drive any output.

If the remote control pressed does not drive any output, the following associations are created:

Key 1 controls output 1, key 2 controls output 2, key 3 controls output 3 and key 4 controls output 4.

- Erase command: all the associations in the receiver memory are erased. Outputs are no more driven by any remote control.

Some important behaviours during learning phases:

- **All the keys pressed on remote frame are sent on the serial link.**
- **The receiver runs in learning mode when one of the "Add/Remove" or "Erase" entry is set to a logical '0' or one of the AT registers (ATS801, ATS802, ATS803, ATS804, ATS805) is set with another value than 0.**
- **"Add/Remove" and "Erase" must not be simultaneously set to "0".**
- **The AT commands have priority on switch inputs. If one of the AT commands ATS801, ATS802, ATS803, ATS804, ATS805, is set with a value different from 0, the switch inputs are ignored.**

The following tables summarize the learning mode capabilities and the procedure to ensure associations between serial number + key and digital outputs.

ADD / REMOVE OPERATION for a selected output	
<i>(See hereafter restriction for keys remote control)</i>	
Using command and selection inputs	Using AT commands
1/ Select the "Add/Remove" mode by setting the Add/Remove input to "0". 2/ Make sure "Global" and "Erase" are not activated. 3/ Select the output that the remote control will drive by setting "Sel0" and "Sel1". 4/ Press the key of the remote control which will drive the output selected. 5/ Exit the "Add/Remove" mode by setting the Add/Remove input to "1".	1/ Enter one of the following AT command: ATS801=2 to select output 1, ATS802=2 to select output 2, ATS803=2 to select output 3, ATS804=2 to select output 4. 2/ Press the key of the remote control which will drive the output selected. 3/ Exit the "Add/Remove" mode by setting the ATS80x register used to 0.
Two possible results of operation: <ul style="list-style-type: none"> • This association was set previously. The association is removed. The LED blinks twice. • This association was not set previously. The association is set. The LED blinks once. 	

ERASE OPERATION for a selected output	
<i>(See hereafter restriction for keys remote control)</i>	
Using command and selection inputs	Using AT commands
1/ Select the "Erase" mode by setting the Erase input to "0". 2/ Make sure that "Global" and "Add/Remove" are not activated. 3/ Select the output for which the associations have to be removed by setting "Sel0" and "Sel1". 4/ Press the key of any remote control to perform operation. 5/ Exit the "Erase" mode by setting the Erase input to "1".	1/ Enter one of the following AT command: ATS801=1 to select output 1, ATS802=1 to select output 2, ATS803=1 to select output 3, ATS804=1 to select output 4. 2/ Press the key of any remote control to perform operation. 3/ Exit the "Erase" mode by setting the ATS80x register used to 0.
Result of operation: The selected output can no more be activated by any remote control. The LED blinks twice.	

ADD / REMOVE and ERASE OPERATION: RESTRICTION for 8/24Keys remote control:

When using the functions ADD/REMOVE or ERASE for a selected output, mixing remotes control with 4 keys (key 1 up to key 4) and "key number higher than 4" (key 5 up to 24) must be done carefully:

- An ADD operation for a selected relay with a key ≥ 5 will be seen as a global add (for example key 5 will be associated to relay1, key 6 will be associated to relay2, key 7 will be associated to relay3, key 8 will be associated to relay4)
- A REMOVE operation for a selected relay will perform a global remove if the record has been performed for a key ≥ 5 (for example if key 5 is associated to relay1, key 6 to relay2, key 7 to relay3, key 8 to relay4, ALL the associations will be removed)
- An ERASE operation for a selected relay will perform a global erase if the record has been performed for a key ≥ 5 (for example if key 5 is associated to relay1, key 6 to relay2, key 7 to relay3, key 8 to relay4, ALL the associations will be erased)

Global ADD / REMOVE OPERATION	
Using command and selection inputs	Using AT commands
1/ Select the "Add/Remove" mode by setting the Add/Remove input to "0". 2/ Make sure "Global" input is set to "0" and "Erase" input isn't activated. 3/ Press any key of the remote control. 4/ Exit the "Add/Remove" mode by setting the Add/Remove input to "1".	1/ Enter the following AT command: ATS805=2 to select Add/Remove in global mode. 2/ Press one key of the remote control which keys have to be added or removed from the receiver. 3/ Exit the "Add/Remove" mode by setting the register used to 0: ATS805=0.
Two possible results of the operation: <ul style="list-style-type: none"> • Previously, this remote control was driving at least one of the digital outputs of the receiver: then all the links between this remote control and the outputs will be removed. The LED blinks twice. • Previously, this remote control wasn't driving any of the digital output of the receiver: then the following links are created in the receiver's data base for this remote control : key 1 drives output 1, key 2 drives output 2, key 3 drives output 3, key 4 drives output 4. The LED blinks once. 	

Global ERASE OPERATION	
Using command and selection inputs	Using AT commands
1/ Select the mode "Erase" by setting the Erase input to "0". 2/ Make sure "Global" input is set to "0" and "Add/Remove" input isn't activated. 3/ Press any key of any valid remote control. 4/ Exit the "Erase" mode by setting the Erase input to "1".	1/ Enter the following AT command: ATS805=1 to select Erase in global mode. 2/ Press one key of any remote control. 3/ Exit the "Erase" mode by setting the register used to 0: ATS805=0.
Result of operation: All the outputs can no more be activated by any remote control. The LED blinks twice.	

For all of the procedures described, the selected mode can be exited after multiple learning operations. It is not mandatory to exit the current mode and then re-enter it if multiple operation have to be performed. Each action is performed when the key on the remote control is pressed.

TECHNICAL SPECIFICATIONS

The number of remote control that can be stored in the receiver and the maximum current available from the digital outputs depends of each ARF18 receivers. This information is available on the user guide of each receiver.

REGISTER SUMMARY

The register values could be updated using the `ATSn=m<cr>` command. Registers used for learning process are "write only" and cannot be displayed using `ATSn?<cr>` command. The commands are described in detail in each ARF18 receiver user guide.

Access	Registers	Function	Description
W	S801	Start learning process for digital Output 1	'0' : Exit learning procedure (default value). '1' : Enter Erase mode for digital output 1. '2' : Enter Add/Remove mode for digital output 1.
W	S802	Start learning process for digital Output 2	'0' : Exit learning procedure (default value). '1' : Enter Erase mode for digital output 2. '2' : Enter Add/Remove mode for digital output 2.
W	S803	Start learning process for digital Output 3	'0' : Exit learning procedure (default value). '1' : Enter Erase mode for digital output 3. '2' : Enter Add/Remove mode for digital output 3.
W	S804	Start learning process for digital Output 4	'0' : Exit learning procedure (default value). '1' : Enter Erase mode for digital output 4. '2' : Enter Add/Remove mode for digital output 4.
W	S805	Start learning process in global mode	'0' : Exit learning procedure (default value). '1' : Enter Erase mode in global mode. '2' : Enter Add/Remove in global mode.