Droid Control Systems

A New Builder Guide

By RobHowdle

Version 4.0

Control Systems for Droid Builders

Important Notice: Nobody expects you to be an expert. Nearly all builders have taken many years to get the knowledge they have, nobody expects you to have it by the end of the day.

When building an astromech droid, one of the main features nearly every builder wants is the ability to drive their droid around. We are far from a completely autonomous droid like in the movies but small stealthy controllers and large costumes are just some of the ways we can create the effect.

Over the years, many control systems have been created, developed and adapted for R2's and other droids alike. Designed to give certain features, remove possible issues such as interference , increase range and reliability and many more. This guide is hopefully going to assist you in picking your control system.

This guide hopes to enlighten you to the different control systems that are currently available, the pros and cons to using these systems given by the builders who currently use them as well as an informative piece on costs, ease of use, ease of setting up, functionality, expandability etc. Not only to inform you but also encourage you to not be afraid of electronics or experimenting with them. As a club, most builders have seen and tried everything and we encourage all of our builders, especially our new ones to try new ideas. Take existing things and rework them to make them better, come up with brand new ideas, brand new ways of doing things and keep the club evolving.

Handy things to know!

Getting into this hobby isn't something to do on a whim, whilst everything you need to know you can learn on your journey, if you already know some basic electronics or how to work with your chosen material, then that will make your life a bit easy. If you are one of those builders who don't have any knowledge about anything relating to building a droid, don't worry! Most builders don't, yet they still produce beautiful and amazing droids.

You should always try out some basic and simple versions of circuits before spending the money on actual parts, mistakes can be costly and very frustrating, for example, get yourself an Arduino board, a couple of LEDs and resistors and play around with some of the blinking LED sketches that come as an example in the Arduino IDE, this would help you understanding putting components together, working with the Arduino IDE (which you will be doing a lot in this build) and hopefully help teach you to understand the code you're programming.

What basics for electronics should you get before embarking on your droid's electronics? Well, take whatever you think is enough knowledge… Now throw that in the bin because you can never have enough! You should get yourself a basic knowledge of things such as electronic components, Resistors, Capacitors, IC Chips, Switches, Wires and Wire Gauges etc. It's handy when you're building things to know what the components are, what they do and even what they look like.

Basic knowledge of Ohms Law wouldn't go amiss either, Ohms Law lets you calculate the relationship between voltage, current and resistance which is something you will do...a lot...Don't worry though you won't be sat there doing super tricky equations unless you decide to develop your own systems for your droid, in which case, ***"This isn't the guide you're looking for…"***

Research how circuits work, different types of circuits that you might encounter everyday such as your phone, your computer, the Starbucks Drive Thru Intercom. Once you understand how circuits and basic electronics work, creating, fixing and even expanding any system becomes so much easier..

Programming within the club is mostly done using Arduino, a variant of the C# programming language so if you can get a basic understanding of that, you would find it easier reading the code for these systems. Whilst the provided code is a "drag and drop" kind of code, sometimes it does need configuring to your system. Builders and the creators of the systems are always there to help but you get such a huge sense of satisfaction when you are able to work something out and do it yourself!

What is a control system?

A control system is simply a system you use to control your droid. This can be from the motors in the feet which physically drive the droid as well as the motor in the dome which controls the dome rotation. Depending on the type of droid you have will depend on what you need from the control system, for example, mouse droids don't need to worry about adding the motor to control the dome.

Most control systems will also have extra features that allow you to control other parts of your droid such as opening panels, fire extinguisher and many more. It entirely depends on what you want to do with your droid. Some people want their droid to be very basic with the standard lights, sound and movement, however others want all the bells and whistles they see on the big screen.

Types of Control Systems

There have been many developments over the years and I have no doubt many more will come in the future. The below list is the current main Control Systems that are in use at the time of writing, Feb 2020

- Standard RC
- Stealth
- Padawan
    - Padawan360
- Shadow
    - Shadow + MD
    - Shadow + Padawan
- BHD
- R2_Control

Until Arduinos and microprocessors were released the only option for driving an Astromech was using a standard RC transmitter, receiver and speed controllers.

Since then, the control system options have increased drastically due to Arduinos and the options these allow due to the numbers of buttons and button combinations that can be used. The original Arduino based systems such as Shadow and Padawan still exist however they have been adapted and refined for different uses and updated to use modern technology such as using the Xbox360 controller or PS3 controller.

Basic Components

In all of the Control Systems you will find the basic hardware that is required for the system to function. These are required regardless of what system you go for although one or two components may differ and you can find out what you need from the actual Wiki's and threads. Once you have collected the hardware, put together with the correct code you should be able to control your droid. The basics of a control system that are shared across every option are listed below, then extras are needed such as an RC transmitter/receiver or Arduino and appropriate game controller.

- Battery
- Fuse Box
- Main Power Switch
- Voltage Converters
- Drive Speed Controller
- Dome Speed Controller
- Foot Motors
- Dome Motor

With the above hardware you will be able to get your droid moving with basic functionality. Some may argue that sounds should be classed as basics however adding sounds into the equation would then require specific coding tailored to certain gear. A simple task such as moving your droid forwards and backwards can be done with very little code and gear.

Standard RC

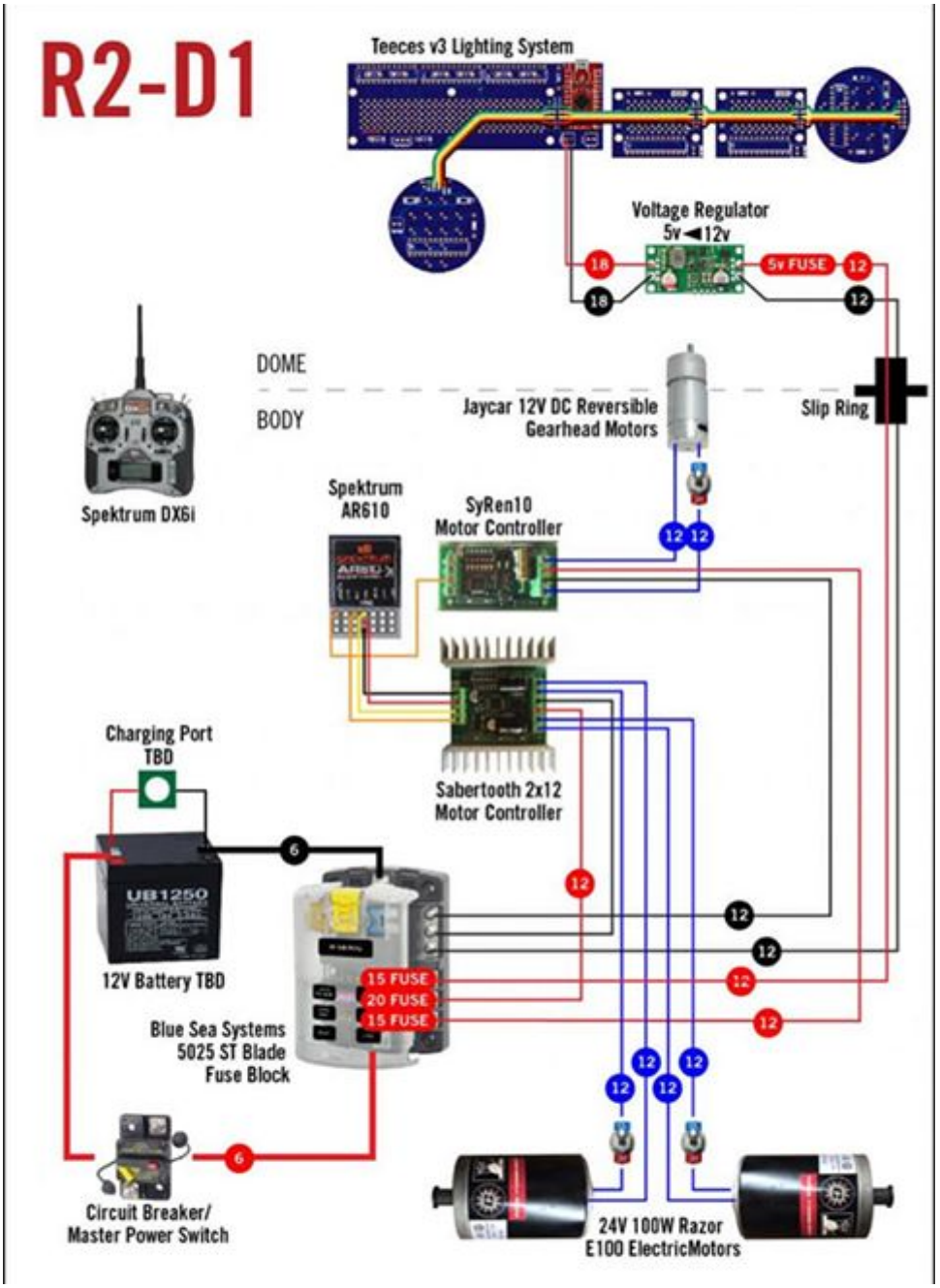
Support: N/A

Astromech Wiki Entry: [Click Here]

Turnigy and Spektrum DX6 RC transmitters

RC Systems are the most commonly used due to people growing up with RC cars as children and used to the controls with a large swing on the control stick, compared to a shorter game controller like the PS3. The cheapest RC transmitters have 4 channels which is enough for the drive and dome. More expensive transmitters are available and these add more channels and are more programmable.

Basic RC is the simplest control system to implement as it's mainly plug and play without any programming knowledge or configuration required. The basic diagram below shows how the various components are connected.



(Standard RC Setup Image by Paul Carter)

Any control system using 2.4GHz is prone to interference or saturation of the frequency band, however RC transmitters are less prone to interference compared to console controller based systems.

RC transmitters have a fixed number of channels so if you want your droid to have everything and I mean everything, 2-3-2, smoke generator (bad motivator), opening dome panels, periscopes and lifeform scanners, body panels, body tools that extend out then you need to look at more in depth options. Some of our builders developed systems such as the MarcDuino and RTouch App. This basically allows you to use your RC system to control your

droid and maybe a few other bits and bobs but all your sounds and panel work etc are all done through a mobile phone app. Most builders use an old phone and 3D print a holder to attach onto the controller.

Not only that, LeeT has also developed a system where you can control sounds using different channel switches on your controller which is a great way to make use of those channels but also if you don't want the setup of using a phone. Lee has kindly created a great video demonstrating this with a sound module which you can find here - https://www.youtube.com/watch?v=hgHiMZfVQc4&t=9s

Pros of using the Standard RC System

The main benefit of standard RC is it's relatively cheap and easy to get started, a 4Ch can be purchased for as little as £30 and a Turnigy 6Ch for just over £40 and it comes with a receiver which will connect directly to the dome and drive speed controllers.

As previously mentioned, there are a lot of pros of using a standard RC system is that it is less prone to interference which is some of the best news for any builder and droid operator, there is a lot of support in the community for it and should your droid ever get selected to be in anything movie/ tv related where it needs to physically move, you don't need to change your control system.

Cons of using the Standard RC System

Some of the issues with using the RC systems is that firstly depending on what you go for, it can become costly, if you decide you want a 18 channel Spektrum transmitter then other options quickly become cheaper options for example.

A big downside is the inability to trigger selected sounds from a standard RC transmitter, and you can only trigger a few sounds, or play 'mood' sounds using the system such as the one shown from Lee above. Typically builders use a 12/15ch RF remote to play selected sounds on a droid, which means having a transmitter and separate sound controller.

Is this control system suited for you?

Depending on how far you want to go, I hope that as a new builder you do have great plans for your droid, using a standard RC system from the start could save you a lot of trouble later on. Out of the box, the hardest things to do are working out which channels to use and which ones need reversing.

Out of all of the support threads on the forums, I see more posts for non Standard RC systems than anything else, however I should add that not all of these are problems, a lot are just questions and general information.

Padawan System

Original Padawan Wiki Link - https://astromech.net/droidwiki/index.php?title=PADAWAN

Support: Not Supported

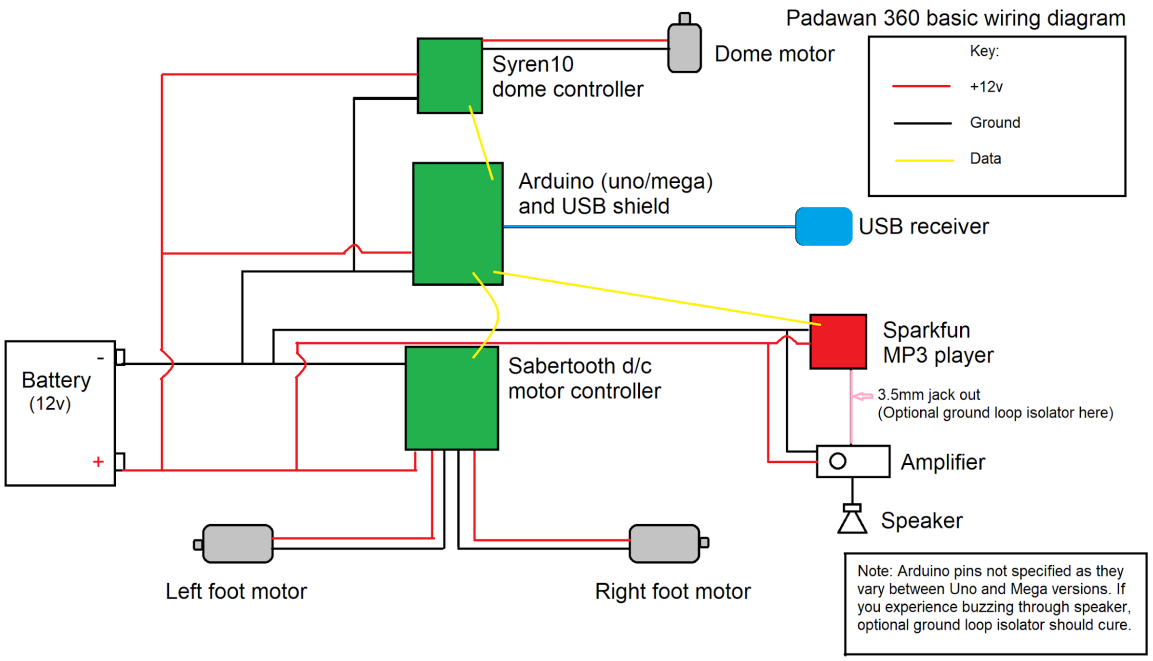
The Padawan System was created by DanF, originally designed to work with a wireless PS2 (Playstation 2) Controller. This system was made up using an Arduino (UNO, Pro, Nano), Extension Cable, Sparkfun MP3 TRigger, Amp and Speakers (or amplified speakers), Syren 10 Dome Motor Controller, Feet Motors and a Sabertooth Motor Controller (2x12,2x25,2x32), Slip Ring, and the Teeces Light Set.

Doesn't seem too complicated right? It's not! Dan has provided fantastic documentation and instructions on this system. The reason this system was upgraded was because it was found the wireless PS2 controllers were becoming more difficult to obtain for some and they were becoming unreliable.

Padawan360 System

Support: Supported
Original Astromech Wiki: http://astromech.net/droidwiki/PADAWAN360

(Padawan360 Image by Rob Howdle)



(Wiring Diagram by Steve Baudains)

Dan Kraus released the Padawan360 System as an improvement to the Padawan, but uses the more available Xbox 360 controller. It is one of the most popular Arduino based systems within the club to date. Dan has noted that it's a great help being able to take advantage of the LED Ring on the 360 controllers which can indicate things from the motors being engaged/ disengaged as well as the speed setting of the droid.

The Xbox 360 controller uses 2.4GHz and uses frequency hopping to avoid interference. One of the most accepted changes from the original system is the fact Dan has used more accessible components, instead of having to solder, it has become a lot more plug and play which is great news, unless you really enjoy soldering things.

Dan is still adding bits to the code and many members are making alterations such as the recent option for left hand drive (gamers will appreciate this change) and also an adaption for the T3 Builders Club which includes many more triggers with plans to add more movement to the head including a 3 axis movement for the T3 Head (this feature wouldn't be usable for an R2).

The system is also extendable which is great news for anyone who may want to stick with the system and add their own features to it but if not, it is a great system for anyone both long term or just starting out.

A lot of the 360 System is the same as the original with some differences that are all documented. You can view Dan's Padawan360 Documentation here - https://github.com/dankraus/padawan360

For video documentation on setting up the Padawan360, Steve Baudains from the UK R2 Builders has done a very informative and well presented video series which can be found here - https://www.youtube.com/c/imperiallightandmagic

An addition certainly worth noting is that with the Padawan360, finding official Microsoft Branded USB Dongles has become challenging and many builders have had to resort to purchasing third party products. This has caused many builders a lot of issues in terms of being able to get everything connected and a big thank you goes to DarrenP for taking the time to find the solution. Changing the PID/VID number fixes the connectivity issues. Darren wrote a great Wiki entry on Astromech.net about this and how to fix it.

You can read it here https://astromech.net/droidwiki/Cheap_XBox_Receivers

Pros of the Padawan360 System

With all systems, there are good parts and bad parts. Using the Padawan360 system myself, it is rather simple to set up even for those who may not be very confident with electronics. The documentation and videos give you all the help and answers you need so I would suggest keeping those handy at all times! The use of the Xbox 360 Controller over the PS2 controller is the first obvious pro since the 360 controllers are a lot easier to get. The code itself is very simple to work out and find out what is happening leading to much easier troubleshooting and bug fixing.

Every component is off the shelf and assembled together and no special parts are required. If you have a traditional RC setup then the transmitter and receiver can be replaced with an Arduino and Xbox 360 controller with minimal effort.

Cost is also an important factor to almost every builder. The Padawan360 isn't a very expensive system compared to others so if you are unable to spend a lot of money on the more expensive systems, this can be a cheaper alternative.

Cons of the Padawan360 System

Some of the negatives of the system is that the controller itself is not very easy to hide unless you are wearing clothing with huge pockets or spend your day with your hands behind your back and don't need to look at your controller. A lot of builders when operating their droid like to add to the magic of R2 and Droids in general by simply hiding the thing that is controlling them. It's a perfectly valid point as some of the controllers are huge and not something you can hide easily if at all however the Xbox 360 Controller is very small compared to some RC controllers and is more hideable than others..

Is this control system suited for you?

So the main thing you need to ask is “Is this system what I need?” Since this guide is only to give you a basic knowledge of all the available systems you should make a first choice on the basis of what sounds more up your street.

A summary for the Padawan360 would be that it’s an affordable system that is easy to put together and most suited for beginners on their first build. That said, there are plenty of experienced builders using this system so it is by no means only a “beginner” system; it is simply easier to understand and put together than other systems.

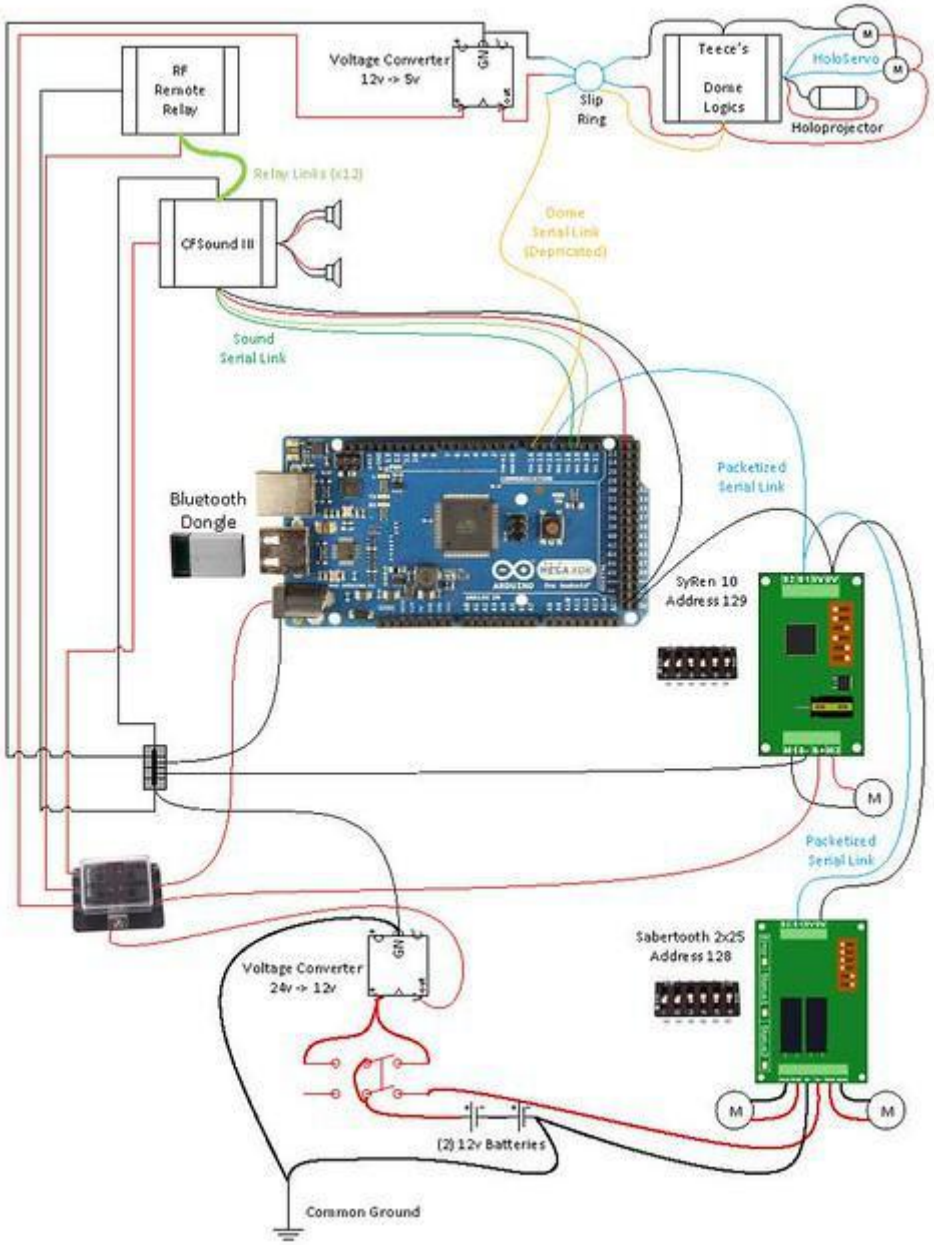
SHADOW

Original SHADOW Wiki Link - https://astromech.net/droidwiki/PADAWAN_SHADOW

SHADOW + Padawan

Support: Not Supported

(PS3 Controller)



(Stealth Images by LordHotWing)

The SHADOW control system, Small Handheld Arduino Droid Operating Wand, like the Padawan360, is heavily based on DanF's Padawan System. One of the main differences is that instead of a PS2 or Xbox 360 controller, it uses a PS3 Move Navigation Controller instead. Darren Blum who created the SHADOW system was mostly looking for the ability to add some more automation whilst still using what the Padawan system already had as well as have an easily hidden controller.

The SHADOW system and all of its descendants are extremely popular in the Droid Building Community most for its ability to easily fit in a pocket away from public view as well as the fact that so much can be packed into a single controller.

Equipment wise, as you'd expect it's pretty much the same as the Padawan system, are you surprised?

Pros of the SHADOW + Padawan System

Some positives of the Shadow + Padawan system is that if you have at all change from the Padawan system for any reason, you wont need to change every component, you will have to change things like the controller and the Arduino as this system uses a Mega, not an Uno. As well as that, with it being based off the Padawan system, it is known for being a nice, cheaper alternative to other systems that the club uses, using this system but wanting to use the PS3 controller over the Xbox 360 controller is simply personal preference.

Another pro of this system is something that is constantly talked about and it's the fact you can hide the controller. Depending on what you plan to do with your droid this is a huge benefit to some people.

Cons of the SHADOW + Padawan System

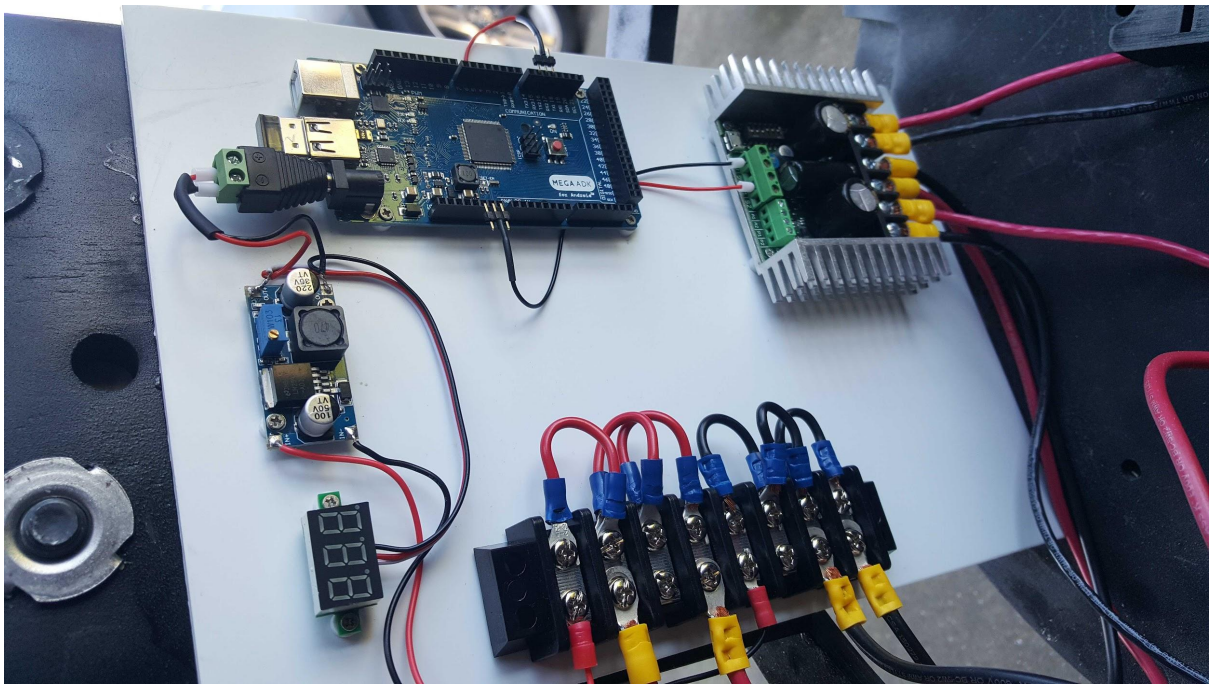
A negative of this system that some builders have reported is that you are limited in what you can do with the system, an example would be with the standard SHADOW system, you don't have built in features for things such as opening panels, smoke machines, other servo control etc.

Is this control system suited for you?

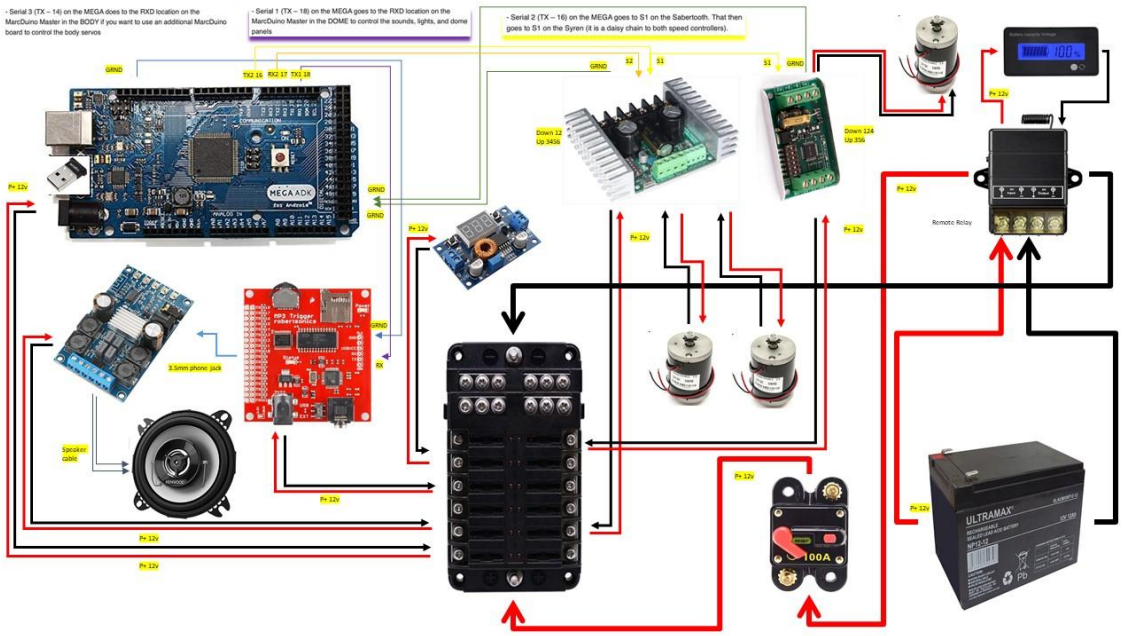
The summary for this system would be that it's very similar to the Padawan360 with the exception of the controller and possibly a few other pieces that you can find more specifics on the Wikis. This system would be ideal for somebody who wanted something very basic, if the builder didn't plan to have opening panels and special sequences and features just simply driving your droid, spinning the head and playing some sounds. On top of that if the user planned to do events where they really wanted the controller to be hidden, this is the system for you.

SHADOW_MD

Original SHADOW MD Wiki Link - https://astromech.net/droidwiki/SHADOW_MD
MarcDuino Link - https://www.curiousmarc.com/r2-d2/marcduino-system
Support: Not Supported



(ShadowMD Image by VinnieTheScar)



(ShadowMD Wiring Diagram by Chris Carpenter)

SHADOW_MD is simply the Shadow System that is connected up to the Marcduino System. MD stands for MarcDuino which is a system created by CuriousMarc that controls the animatronics of an R2's dome panels, lights and sounds from an iPhone.

The SHADOW MD system combines the SHADOW Arduino sketch with the MarcDuino control boards. Why would you do this? It allows the builder to then control both the movement of the droid as well as all of the MD sounds, lights and panel movements all from the same PS3 controller. This is basically the next step up to the standard SHADOW system which is very basic in comparison but still allows the user to have the PS3 controller.

Open Source

If you're unsure, Open Source means that everyone is welcome to take the project and make it their own. SHADOW MD is an open source project which means you probably will not find any two people running the exact same code unless it's the initial stuff that just been configured but not adapted. This is great for people who want to customise what they do, of course all the code is customisable but this makes it even easier in the sense of providing a good solid foundation for builders to develop on.

Building your own MarcDuinos can also save costs on this system, you should check out the CuriousMarcs website - https://www.curiousmarc.com/ - for more information about the MarcDuinos.

Pros of the SHADOW_MD System

The SHADOW_MD System so far seems kind of ideal right? Nice system, small, concealable controller and you can control almost every part of R2 with a single controller. As with the Padawan 360 System, this version is designed to use off the shelf parts most of which are a case of plug and play. Even if you don't want to have moving panels straight away, using this system at least gives you the options.

Ability to add a second controller as well for extra functionality, only expands the systems capabilities. They even have a dedicated Wiki to showing you how to make changes to the code which can be found here:
https://astromech.net/droidwiki/SHADOW_MD_Customization

Cons of the SHADOW_MD System

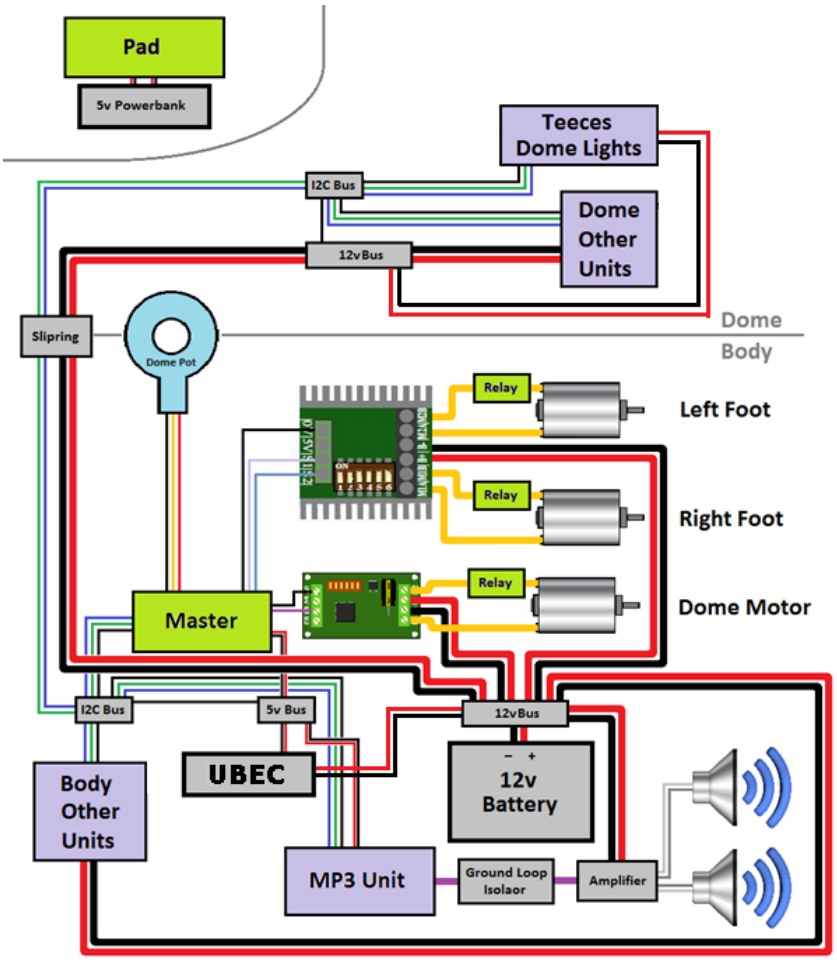
People don't seem to have had many problems with this system, or if they have, they have been fixed. One issue that seems to be common amongst some builders is the Bluetooth Interference that can happen at large events. The events described where this has occasionally happened are large Con events, hundreds of people all with other devices operating on the same or similar frequency that's causing interference. Even then this isn't a total deal breaker because most of these issues are due to the distance between builder and droid and can be resolved simply by getting closer to the droid, within around 20 feet at worst should be fine but you should experiment to find the best practice for your system.

Is this control system suited for you?

In my opinion, this system sounds like an extremely affordable and practical system as well as being completely open for customisation. If you're good with coding then this would probably be heaven for you, if you're not that confident or interested in coding then that's OK too since it has a great starting platform that is more than enough for a standard droid.

BHD

Support: **Not Supported**
Documentation: https://drive.google.com/file/d/0B5B8A65frsBgSFR0UlJuOTlKM2c/view



(BHD Wiring Diagram Image by Brad Oakley)

BHD is a custom control system created and developed by Brad Oakley. It's designed to be used with both simple droids that may have sounds, a couple of lights and move around or with a complex droid. The system is built using a PS2 Control Pad and a little army of Arduinos that are set up to communicate over I2C. To help you understand how the system works, you can think of each section as a unit. It was designed to have compulsory units, to sections that you need to have in order for the system to work, these are things such as batteries, controller, Arduino, Drives, Speed Controller etc so basically it's your basic control system.

Once you have the compulsory units required you can in fact run the system without any problems. This would only drive your droid though and even then the dome motor is optional but it's usually thrown in there under the basics.

If you have got that far without any/ many issues and it works you'd probably be quite excited to carry on because what is R2-D2 without the beeps, boops and whistles? That's where you'd then add optional units such as the Sparkfun MP3 Trigger, Teeces Dome Lights, 2-3-2 Controller etc.

There are lots you can do with this system which is fantastic especially if complex droids but it is also perfectly suited for a more simpler droid.

The system goes much more in depth than other systems in terms of fail safes and security and helps to give the user more control over the droid than a standard system. Some examples would be on the PS2 Controller, pressing the L3+R3 buttons at the same time performs an emergency stop on all motors, as well as if the Master Arduino detects missing packages from the controller, the droid and dome stop.

Pros Of BHD

BHD is the product of many years of research and development. All systems have had a lot of time and care put into ensuring they are the best they can be, this system has been put through a whole range of tests, probably more tests that a system needs to pass but the BHD system ticks more boxes in functionality and options than most if not all others, extra security and fail safes etc.

The amount of features you can have using this system. Whilst it is similar to the Shadow_MD in terms of you can add to it if you wanted to, BHD is more of a system where you have a MIN and MAX and you can simply add what you want, keep out what you don't want without having to work out how to alter code to not require other units.

Cons Of BHD

Depending on how you are using the system, the overall layout can be quite daunting to new builders, especially those who may not be confident in electronics. Whilst some parts may be tricky at first, a lot of it is simply a case of understanding what is going on, what part does what etc. Once you understand the concept of the system and how it works, putting it together and configuring it will be much easier (in theory).

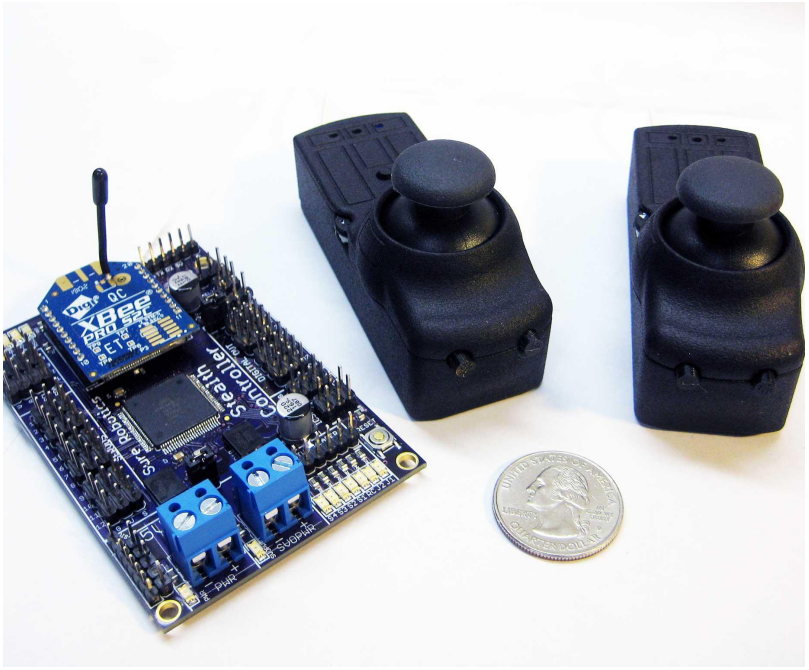
Is this control system suited for you?

This system can be for everyone, it's designed for droids of all stages of complexity from simple all the way to very complicated however depending on your confidence level this system may look quite big and scary. This system does require a bit of work to get running and isn't much of a plug and play like other control systems are but if you are the type of builder who is up for a bit of a challenge then this is certainly a good system to look into.

PLEASE NOTE: Brad does NOT support this system, if you decide to build this system, please build at your own risk.

Stealth System

Original Astromech Forum Post - https://astromech.net/forums/showthread.php?13485
Guides - http://www.surerobotics.com/doc/Stealth_RC_Quick_Start_Guide_v1.3.pdf
- http://www.surerobotics.com/doc/Stealth_RC_Reference_Guide_v1.11.pdf
Support: Supported



(Stealth Image by Chris James)

The stealth system was developed by Chris James, a member of the Builders Council on the Astromech.net forum. Originally coming from being an extension of a PS2/XBee setup it was later constructed as its own controller.

As you should be able to gather from the name, one of the key parts of this system is being able to hide them easier without reducing the functionality of the system. At the time of writing this, Stealth is one of the more high end popular systems. The stories from builders using this system have been all but positive. People who have used the system have often praised it for being highly concealable to the point where they have stood next to a member of the public whilst controlling their droid and the public have not noticed.

Functionality is something that is also important, having the toss up between having a small controller that you can easily hide but only really being able to move the droid and that's it or having a larger controller that is more difficult to hide but you can control servos, sounds, lights and extras.

The system has a lot of different features that would be very useful for a builder depending on their type of build and budget.

Pros of the Stealth System

Some of the best parts of this system as described by its users is, it has one of the best controllers to use whilst keeping them hidden from the public's view. Sometimes you'd find with small yet awkward or bulky controllers that you may struggle to hide them when driving your droid out in public. The controllers also have the ability to use 900MHz radios as well as 2.4GHz which gives less interference and longer range however this can be limited to certain countries.

Another few pros of this system is that it is easy to use, by that I mean physically using the controllers as well as being able to add in extra servos for gadgets, doors, panels etc as well as adding in new audio to play as well as triggers. The battery life is also impressive, being able to go between 4-8 hours on a single charge as well as being able to stick in your charge cable and use the system whilst it charges. As well as buttons, the system also uses a gesture based system to trigger even more events and sounds allowing for even more to be done with the system.

The system also allows you to interface with older legacy control systems such as J.E.D.I which is perfect for any older builders looking to upgrade their control system. The Stealth System fully integrates with other systems via i2c, serial and Digital IO as well as having advanced options for Auto-Dome movement and other automation.

Everything you need to get it running is pretty much right out the box so you don't need to be searching through a load of websites trying to order different parts to put it together which is great for any builder.

Cons of the Stealth System

Cost is something that can be considered a problem for some builders, especially those on a budget build, the system can start at around $650 (£500) roughly but depending on what you purchase the cost could rise, some new builders who are on a budget. Whilst not completely open source like systems like Padawan360, the Stealth System does have its own community who share code for Stealth Arduino based Servo I/O Expanders with each other which can contain new features, bug fixes, alterations etc. Chris has even set up his own forum which you can join and get involved with this community - www.surerobotics.com/forum

Is this control system suited for you?

Are you looking for something really cheap to get things going? Probably not. Are you looking for something that you can upgrade at your own pace and don't have to spend a long time trying to find all the parts and then worry about if they're the right parts etc? Most likely yes. Also if you are wanting a stealthy system if you are intending to do events where you

want your controller hidden but not lose all the functionality that comes with having a small controller.

R2_Control

Original GitHub Repo: https://github.com/dpoulson/r2_control
Support: Supported

R2_Control was created by UK R2 Builder Darren Poulson who designed the system for Raspberry Pi as well as an i2c bus and custom hardware to control all aspects of the droid. I have personally seen Darren's R2 unit and I can vouch for how great this droid is and the amount of features it has is brilliant.

The system uses a core Raspberry Pi which comes with onboard Wifi and Bluetooth which is connected to the i2c bus through the GPIO pins. Sounds complicated right? All systems sound complicated, especially to builders new to electronics but don't fear, Darren has highly documented instructions and is happy to help with anyone wanting to use the system.

The system provides a REST API which means the code that creates the control system can be written separately from the main code that does all of the core functions. The system is open to using different Joystick controllers thanks to the API such as a PS3 controller, PS Move controller or a Wii controller.

Current expansion of the system includes a Telegram (instant messenger system) meaning R2 can interact over the internet. Future expansions are Voice control, images, gps, computer visualisation and even a drinks dispenser!

Pros of the R2_Control System

Since this system is pretty "new" and only a handful of people currently run it, the main pros that have been found is simply the ease for expansion. Current ideas for expansion that we already spoke about are not what the system is limited to, with it being open source anybody can create a feature and then share it.

Since this system is using a Raspberry Pi, you do not need a separate MP3 trigger board for sound. Any amplifier plugs directly into the Pi's onboard 3.5mm audio. With the number of sounds only limited by the size of the SD card.

Cons of using the R2_Control System

Again, with it being such a "new" system where not many people currently use it, it's difficult to find problems with it however an issue people may see is that by using the Raspberry Pi, you find yourself running a full OS on your droid rather than an embedded system. This is overkill however you do get more power as a result so it depends on your point of view as to whether this is a con or not.

Is this control system suited for you?

Again, similar to the BHD system, if you are the sort of person who wants a challenge in setting up and programming with the ability to create your own features then this is certainly the system for you. Darren is always around and happy to help out anyone using the system and does plan to do more work on it when he can.

R2-Net Server

Documentation: https://x-circuits.com/en/r2-net-server

R2-Net Server was created within the Astromech Spain group by Julio Montagut Desco. It's a module which uses a Linux Operating System and has hardware that allows you to generate your own Wifi access which is then used to connect to a web application that controls the droid. There are many more features of this system such as being able to connect other devices such as phones, tablets and computers to the generated Wifi and having complete control over your droids startup and shutdown configuration.

You don't have to use this system via the web interface, people have been able to adapt this system to use controllers such as the PS3 Move Controllers that are commonly used with the Shadow System.

The system seems to have many features that give you a great deal of control over your droid and what it can do. Not only that but the information about the control system is extremely well laid out and includes a list of materials and clear wiring diagrams. We have provided links below to people using this system in action.

https://www.youtube.com/watch?v=RqNxp951Bmo&feature=youtu.be - Using a PS3 Move Controller to demonstrate movement functions

https://www.youtube.com/watch?v=2-wYUkcSADo&feature=youtu.be - Using a tablet and web interface showing the system working with a Teeces Light setup

https://www.youtube.com/watch?v=k0qNakjY6q4&feature=youtu.be - Using the PS3 controller again with full functionality shown.

Pros of the R2-Net Server

The system looks to be very well designed and built. It has a large amount of functions built into it that a typical builder would want. The web interface is very neat and well laid out as well as being clearly developed for modern devices meaning you are not limited to what you can use to run the control system. There are builders within the Astromech Spain Community who are using this system who have confirmed that they are happy with it and they believe it to be a very good control system to use.

Cons of the R2-Net Server

Currently, the only people to my knowledge using this system are members of Astromech Spain so for anybody who is outside of that specific group who wanted to use it, whilst you still can you may struggle for support outside of the Spain Club. This system is not a “new starter” type of system. Even though it does include some great wiring diagrams and information on how to set it up, my opinion is that this system would be too complicated for anyone new to the hobby who might already be confused in the electronics world.

Thankfully we have such a wide range of abilities within new members there is a good chance that you might be the sort of builder who is very interested in these types of systems in which case you should take a look. Without having this system myself or seeing it physically in action where I can ask plenty of questions I cannot be 100% certain that the system ticks all the boxes however the response I have had from builders using the system gives me confidence it is a safe and good system to use.

Is this control system suited for you?

Well, that all depends on what sort of builder you are. If you are a builder who doesn’t mind a bit of a challenge and really getting stuck in to make something work then sure! Also if you are somebody who uses Linux as an operating system you could find this system interesting to look at and possibly even expand on. If however you are a builder who wants something easier to use and step up, perhaps you prefer a physical controller than a tablet then I wouldn’t advise this system for you.

There seems to be a lot of hype within Astromech Spain about this system and I personally do see it eventually making its way into the more mainstream worldwide Astromech Community eventually.

Kyber

Astromech Thread:
https://astromech.net/forums/showthread.php?41402-Kyber-Controls-System-(*-LIMITED-STOCK-July-2021-*)&highlight=Kyber+Control
Support: Supported

(Image provided by Matt Hobbs)

The Kyber Control System was built by Matt Hobbs & Stephane Beaulieu in an attempt to expand the possibilities of what we can do with our receivers. It was created to be as simple as possible to install and set up yet give the builder a wide range of extra features that you cannot get with just a single standard control system. The Kyber system is RC based so if you are using any other kind of control system there isn't a way to incorporate this into your existing system (yet!). For those RC users, you are in luck. Currently the system has been tried and tested with the ever popular DX7 and it essentially is a way for you to get a lot more buttons than you currently have.

For example, you can turn a 3 position switch into 3 buttons which gives you the ability to have up to 30 extra buttons. Imagine what you can do with 30 extra buttons?! This isn't without a bit of customisation however, you do need to modify your existing controller to allow for these buttons to be installed however don't worry, the modification is only small. So what can you do with these buttons? Well you can control sounds either as a single sound per button or you can even set up a bank of sounds, you can control motion by using the Maestro circuits boards which are servo controllers, and even do both at the same!

The system requires 5-36V which removes the need for any regulators to be installed and one of the best things is that you don't have to know programming to set this system up. The system uses a built-in Wi-Fi module which also comes with a Web App that takes you through the setup process. Another perk of the Wi-Fi module is that you don't need to dismantle your droid in order to plug the system in for updates/ reprogramming. The system comes with a sound card, 8" output jack as well as an onboard amplifier and some EQ settings.

The Web App is certainly something worth mentioning separately. The system comes with an operations manual which takes you through everything and how everything works but the web app itself is very simple to use. Naturally you do need to understand what you're doing otherwise a lot of things will just look like random words but as far as becoming a full time programmer, the web app saves you so much time. So what are the requirements for this system? Not a lot! You have to be using an RC System so something such as the Padawan360 currently is not supported. Also this system works using SBus so you would need to check whether you have that if you are unsure. The Kyber system is also compatible with Marcduino using RTX. All of this is done whilst using the minimal amount of channels possible.

Pros of the Kyber System

The Kyber system is a very modern approach to controlling your droid. It gives the builder many extra features that do not come stock with traditional RC Systems. It has high storage for sounds as well as live feedback on the web app meaning when you press a button, you can get response from the system to the web app in real time which is extremely handy for any troubleshooting. The system in general is highly documented and supported through the community and is also being used in many droids, not just R2-D2 but droids such as a Mouse Droid, BB8 and Wall-E. For basic functionality you need no coding experience however the more knowledge you do have will be highly beneficial. The onboard sound system would be highly desirable providing you do not have one already but I think the best part about this system is it is designed to simply be dropped right into your droid without any major surgery.

Cons of the Kyber System

Whilst no system is without issues, the Kyber does have a few. Firstly, as I mentioned this system is purely RC based at the moment. There may be an option for non-RC systems in the future however as of right now, anybody not using an RC system will not be able to use this unless you change your control system entirely. You also do need some knowledge of RC in general, whilst you don't need much programming knowledge, a working knowledge of RC would be highly useful. Another con is that unfortunately if you are going for a small controller that can easily be hidden, this system would be the wrong move for you. The RC controller in general can be quite large and these extra additions are not exactly streamline. Whilst the system is fairly simple to set up and install, it isn't quite 100% plug and play.

Is this control system suited for you?

It would be my opinion that this system is certainly worth looking in detail at. The first and obvious question you need to ask is whether you plan to run an RC system or not, if the answer is no then you can skip this system entirely. If you are a builder who is planning to have a lot of functionality, even if you only want lights and sounds, this system can give you even more options for that than the standard setup whilst not using many channels. If you are the type of builder who is always adding things and wanting to put in something new to your droid but doesn't want to have to choose between what features to keep and what to lose, I would highly recommend this system. The overall response from the community has been very positive and I can only see this system advancing further and further giving more builders more control and more options on what their droid can do. Following the astromech link - There are a number of videos and documentation which should answer any questions you may have as well as a link to a dedicated Facebook Group.

Archived Systems

As of Version 1.1 of the Control System Guide, many people have requested information for things that are no longer used as a standard system within the club. I have added this section in the hopes that all systems that are no longer used but still hold some form of significance whether it is for people still using the systems or purely for historical purposes, will be listed here with any links.

Website: https://sites.google.com/a/jedicontrol.com/www/

The J.E.D.I Control System (I'll refer to it as JEDI) is one of the earlier systems that was created by AZSquib that allowed you to control all of your droid features with a single 6 channel RC receiver by using a Receiver Converter. It was used by many builders and is still used by some today.

The original website is now offline and the above link is currently the only way to access the information.

Other Systems:

That isn't everything, I would be bold enough to say that there would be hundreds if not thousands of control systems you *COULD* use. The reason I say that is because the majority of these systems, people have taken and played around with to make their own, sometimes it could be small things like swapping which buttons a certain sound plays, swapping which stick drives the droid etc. Some systems don't do everything, they only do certain things however depending on what you want, your budget etc they could be worth looking into.

12 Channel Remote: https://astromech.net/droidwiki/12_channel_remote

A great little system if you want something super simple, easy to hide and easy to use to trigger your sounds. Using a small and cheap 12 channel remote, this thing simply has 12 buttons that can trigger loads of different sounds. The receiver and programming of the receiver is pretty straight forward too, again like everything requires patience and the urge to just go for it.

Autonomous Droiding:
https://astromech.net/droidwiki/Autonomous_Droiding_(using_ROS)

Tell me at no point throughout this guide have you wondered if anybody has made/ is making a system that lets R2 be autonomous? Well, a builder is actually working on that! Whilst I don't think there has been much work for a number of years and by the looks of it there doesn't seem to be any hint of him returning, Björn Giesler created this system for R2 using lots of sensors in the droid giving all kinds of information about the droid, to environmental sensors as well as a robot brain! Certainly something to look into, even if it's just for your own curiosity.

Shady RC dEvolution: https://astromech.net/droidwiki/Shady_RC_dEvolution

No, that's not a typo. This system I find as one of those systems that bridges a lot of gaps, whilst it was not supposed to be a super perfect very smooth multi-functional system, it works! Remember the old saying, "If it isn't broken, don't fix it", well in this case the system was designed due to an original PS3 controller dying and an event requiring traditional RC only transmitter to control your droid that may already be set up with systems such as the Padawan or Shadow systems.

Common Systems for Droids

Back in the day, there was only R2-D2 really, maybe a couple of other droids such as a mouse and an R5 unit but that's about it. These days we have so many droids popping up all over the place, not one system can control them all (yet!). Droids are certainly not limited to any type of system, it's mostly a case of which system is best suited for that droid, some systems for example could have features that are entirely suited for R2-D2 but not D-0 so you might ask what the point of using that system with D-0 is?

I've compiled a list of some of the common systems that members building different droids use which should give you a bit of a nudge in the right direction if you are building something other than or as well as an Astromech:

D-0:

OpenTX RC - Michael's OneDrive Instructions
Modified Shadow
Padawan PS4 - https://github.com/redheadedstep/padawanps4
Julio Montagut Desco Custom D-O - https://x-circuits.com/en/construction-of-my-d-o

Mouse:

3 Channel 27MHz RC
Shadow
12 Channel Radio Link RC
Futaba RC
Traxxas Bandit RC

Chopper:

Modified Shadow

T3-M4:

Padawan360 (Currently in development with plans to extend to other systems)

BB8:

Modified Shadow Padawan
Carys Drive
Joe's Drive - Shadow - https://github.com/jlvandusen/JoesDriveSHADOW

As you can see, there is a whole range of different systems for different droids that you can choose from. Even these systems aren't limited, we've had people use these systems for other droids such as a Doctor Who K9 and I would even say some of them would be suitable for a Dalek as well as many others.

Going your own way

Sometimes exactly what you want doesn't exist… yet. Whilst for a new builder it may seem an impossible task but there is nothing stopping you from taking something that is almost perfect for your build and making it perfect. It's always polite just to drop the original person who created the system/ code a message asking if it's okay to alter their code for yourself and we then encourage you to share what you have done. The community thrives on people making something new and sharing it, that is progress. Building something and keeping it to yourself halts progress in its tracks.

Final Thoughts

I hope that after finishing this guide, you leave with a better basic knowledge of these systems than when you arrived. Your next steps from here should be picking a system that sounds like what you need and researching more into it. Contact people who use them, create posts asking for advice, read the wikis and do whatever you need to do in order to get the information you need. Most new builders I see tend to stick to the safe and common choices with their builds but the club needs people to do new things all the time and I encourage you to be one of those people.

I see many people who want to build a droid but don't want to spend time doing any research and preparing for this journey but expect everything to work without problems. Sadly that is not the case, even with the most fortunate and experienced builders. Each builder needs to understand how their droid works, not just accept that it does. If you don't understand it,how can you fix it? How can you make it better? How can you make it yours?

There is no greater feeling than when you finally understand something you have been struggling with, that "penny dropped" moment when it all makes sense. Being able to put your control system, or any electronics that you are making, together and being able to understand why Part A connects to Part B, what the purpose of it is, what could happen if it wasn't there?

This next suggestion could be more in the future, or it could be quite soon depending on how much of a challenge you want, the feeling when you create something new. I don't mean re-inventing the wheel, trust me I tried. Do something simple, there are loads of builders who have made custom things for their droid such as Card Dispensers that eject collectable cards of their droid from the Large Data Port, putting a real Projector behind the HoloProjects and actually displaying Leia's message on a wall, making a completely custom droid that makes people's heads turn because it's brand new!

You will get angry, you will get frustrated, you will get disheartened. Many times you will even question why you started this build in the first place therefore it is important to remember why you're here. Why did you start this build?

Everyone in this club is here to help and somebody will always have an answer to your question. There are no stupid questions either, everyone starts somewhere so please don't be afraid to ask questions, my mailbox, as well as many others is always open to everyone!

Credits

Many people have helped make this guide possible, offering advice, links and going round in circles with me helping me understand the systems so I can write them up simply for you.

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- Brad Oakley
- Oliver Steeples

For their assistance in understanding the systems and answering my questions about them.

Special thanks go to the original creators of the systems for proof reading this document to ensure I have understood the systems and described them correctly.

- DanF - Padawan
- Dan Kraus - Padawan360
- Darren Poulson - R2_Control
- Brad Oakley - BHD
- Knightshade - Shadow
- Vint43 - Shadow MD
- CuriousMarc - MarcDuino
- JoyMonkey, Maxstang - Shadey RC dEvolution
- AdamS - 12 Channel RF Remotes
- Björn Giesler - Autonomous Droiding
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Assets

Chris Carpenter who provided the image of the Shadow MD system has kindly provided a downloadable PDF file of his system. Sometimes depending on the device you are reading the guides on, images do not display very well. You can download his PDF file from my website - click here to download.

Other Guides

I have written a number of guides designed to help new builders find their way in this community, figure out where to start and to attempt to take as much information from this community as possible and give the reader a more organised and simplified overview. I have detailed the various other guides I have written below, they can all be found on my website.

https://www.robsrobots.co.uk/guides.php

New Builder Guide
Control System Guide
The World Of Electronics

Updates

Guide updates will be reflected here for the purposes of version control. Full version updates (IE V1, V2, V3 etc) are for a major include IE a new system. Minor updates (IE V1.1, V2.2, V3.3 etc) are for smaller updates such as small additions to systems, system updates etc.

V4.0 - Included write up of the Kyber Control System
V3.3 - Included updated Shadow MD System & Assets from Chris
V3.2 - Included information regarding cheap xbox receivers from DarrenP.
V3.1 - Included other Guides
V3 - Inclusion of R2-Net-Serve
- Inclusion of Julio's D-O
- Inclusion of ` Going Your Own Way` Section

V2 - Inclusion of Archived Systems Page
- Addition of J.E.D.I

V1 - Original Release