

# Off Board BOM

## VB Dynamic DC Load

### The enclosure:

TEKO AUS 33.5 Polystyrene 198x178x108mm

[https://www.reichelt.com/nl/nl/shop/product/polystyreen\\_behuizing\\_198x178x108mm-21208#open-modal-image-big-slider](https://www.reichelt.com/nl/nl/shop/product/polystyreen_behuizing_198x178x108mm-21208#open-modal-image-big-slider)

The AUS 33.5 is the bottom one from this stack.



### The OLED display:

A Waveshare 128x128 1.5 inch color display

[https://www.amazon.com/waveshare-1-5inch-RGB-OLED-Module/dp/B07DBXMFSN/ref=sr\\_1\\_1\\_sspa?crid=2ESRZ9ZDK8XZV&dib=eyJ2IjoiaMSJ9.CtqPbCjEZfvSpF68GI5hvhvkFgvi3jkDHxRzV-IAeTspivc3Mrbp2BeEGA0WkSey2zo9wX\\_ZOaff0CMGs3kkS64Y8oqEOuZXVJG7g8Bur77PsTSCh5eiqmS2Q37uG6GpNTG\\_wYY2hr9IOwKtUmo6RDg4uA8AQUNjwUJmrzcuh\\_b7P5aJa3LjLMfqFRt83rnKhCz7OkmdnmznIEbGljUHda\\_SBS4mqvrzCqrMdqY6ZXs.kM4HffjJ4vmoj5brd0guuLJ9At0tBhnuYsMZO6Og1Ac&dib\\_tag=se&keywords=1.5inch+RGB+OLED+Display+Module+128x128+Pixels+color&qid=1712049477&srefix=1.5inch+rgb+oled+display+module+128x128+pixels+color%2Caps%2C158&sr=8-1-spons&sp\\_csd=d2lkZ2V0TmFtZT1zcF9hdGY&psc=1](https://www.amazon.com/waveshare-1-5inch-RGB-OLED-Module/dp/B07DBXMFSN/ref=sr_1_1_sspa?crid=2ESRZ9ZDK8XZV&dib=eyJ2IjoiaMSJ9.CtqPbCjEZfvSpF68GI5hvhvkFgvi3jkDHxRzV-IAeTspivc3Mrbp2BeEGA0WkSey2zo9wX_ZOaff0CMGs3kkS64Y8oqEOuZXVJG7g8Bur77PsTSCh5eiqmS2Q37uG6GpNTG_wYY2hr9IOwKtUmo6RDg4uA8AQUNjwUJmrzcuh_b7P5aJa3LjLMfqFRt83rnKhCz7OkmdnmznIEbGljUHda_SBS4mqvrzCqrMdqY6ZXs.kM4HffjJ4vmoj5brd0guuLJ9At0tBhnuYsMZO6Og1Ac&dib_tag=se&keywords=1.5inch+RGB+OLED+Display+Module+128x128+Pixels+color&qid=1712049477&srefix=1.5inch+rgb+oled+display+module+128x128+pixels+color%2Caps%2C158&sr=8-1-spons&sp_csd=d2lkZ2V0TmFtZT1zcF9hdGY&psc=1)

Details: [https://www.waveshare.com/wiki/1.5inch\\_RGB\\_OLED\\_Module](https://www.waveshare.com/wiki/1.5inch_RGB_OLED_Module)

### Two Fans:

The two fans are Noctua NF-A9x14 PWM.

[https://www.amazon.com/Noctua-NF-A9x14-Premium-Quiet-92x14mm/dp/B009NQM7V2/ref=sr\\_1\\_1?crid=RIMLK7YHUYG&dib=eyJ2IjoiaMSJ9.nyBCEPUapDaneASOxl51-GoFAI2gneNvo\\_L\\_7y7PvptNYUsWO8vls8muktP-fMtsixiYzGWWNjB\\_pfiOkhMrEkcbExYJ2GUsNunyWm2PBpCvopcJo9UYp2vv9I\\_WEgdxSwcWoaulTG52Eb787wj8LxpJL5M6SYRROFRAS1aSes111bdt36O9wlye3COD3cEAJair7QAdKNhEV9U87LBZ1DnZs7Lem8byVV0Njec3s.fpH4J03QezsT5n-wXBJ0zsEq5JCF2PJ7nk5z6RBp2FA&dib\\_tag=se&keywords=noctua+nf-a9x14+pwm&qid=1726838223&srefix=Noctua+NF-A9x14%2Caps%2C166&sr=8-1](https://www.amazon.com/Noctua-NF-A9x14-Premium-Quiet-92x14mm/dp/B009NQM7V2/ref=sr_1_1?crid=RIMLK7YHUYG&dib=eyJ2IjoiaMSJ9.nyBCEPUapDaneASOxl51-GoFAI2gneNvo_L_7y7PvptNYUsWO8vls8muktP-fMtsixiYzGWWNjB_pfiOkhMrEkcbExYJ2GUsNunyWm2PBpCvopcJo9UYp2vv9I_WEgdxSwcWoaulTG52Eb787wj8LxpJL5M6SYRROFRAS1aSes111bdt36O9wlye3COD3cEAJair7QAdKNhEV9U87LBZ1DnZs7Lem8byVV0Njec3s.fpH4J03QezsT5n-wXBJ0zsEq5JCF2PJ7nk5z6RBp2FA&dib_tag=se&keywords=noctua+nf-a9x14+pwm&qid=1726838223&srefix=Noctua+NF-A9x14%2Caps%2C166&sr=8-1)

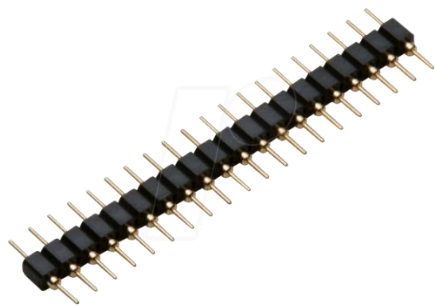
## ESP32 WROOM 4Mb Devkit V1 Board

Make sure you get the unassembled version, without the connectors installed. The ones listed below are for a pack of three but seem to have the diode and the reboot capacitors installed. See the Blog for more details.

[https://www.amazon.com/dp/B09QW6Y7KY/ref=sspa\\_dk\\_detail\\_6?pd\\_rd\\_i=B09QW6Y7KY&pd\\_rd\\_w=uks1g&content-id=amzn1.sym.386c274b-4bfe-4421-9052-a1a56db557ab&pf\\_rd\\_p=386c274b-4bfe-4421-9052-a1a56db557ab&pf\\_rd\\_r=2BP3YYWY5FBW5442JZAJ&pd\\_rd\\_wg=QCono&pd\\_rd\\_r=59a45996-bb27-4ab3-8a51-801088fcc171&s=pc&sp\\_csd=d2lkZ2V0TmFtZT1zcF9kZXRhYWxfGhlbWFOaWM&th=1](https://www.amazon.com/dp/B09QW6Y7KY/ref=sspa_dk_detail_6?pd_rd_i=B09QW6Y7KY&pd_rd_w=uks1g&content-id=amzn1.sym.386c274b-4bfe-4421-9052-a1a56db557ab&pf_rd_p=386c274b-4bfe-4421-9052-a1a56db557ab&pf_rd_r=2BP3YYWY5FBW5442JZAJ&pd_rd_wg=QCono&pd_rd_r=59a45996-bb27-4ab3-8a51-801088fcc171&s=pc&sp_csd=d2lkZ2V0TmFtZT1zcF9kZXRhYWxfGhlbWFOaWM&th=1)

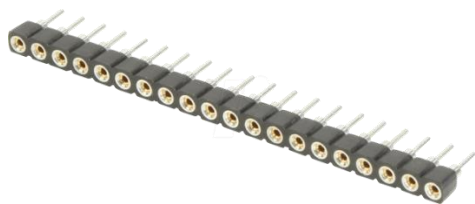
## Male instrumentation header pins for the ESP32:

[https://www.reichelt.com/nl/nl/shop/product/nauwkeurige\\_male\\_connector\\_20-polig\\_2\\_54\\_mm-235666?PROVID=2809&gad\\_source=1&gclid=Cj0KCQjwurS3BhCGARIsADdUH500XkxohRjMcLN8ngMTOhFaHuKWn4UAlD509o8MFIObZYtctC2s\\_MsaAoaTEALw\\_wcB](https://www.reichelt.com/nl/nl/shop/product/nauwkeurige_male_connector_20-polig_2_54_mm-235666?PROVID=2809&gad_source=1&gclid=Cj0KCQjwurS3BhCGARIsADdUH500XkxohRjMcLN8ngMTOhFaHuKWn4UAlD509o8MFIObZYtctC2s_MsaAoaTEALw_wcB)



## Female instrumentation header pins for the ESP32:

[https://www.reichelt.com/nl/nl/shop/product/precisiecontactdoosstrook\\_2\\_54\\_mm\\_20-polig-119950#closemodal](https://www.reichelt.com/nl/nl/shop/product/precisiecontactdoosstrook_2_54_mm_20-polig-119950#closemodal)



## DC Power Jack Panel Mount:

[https://nl.aliexpress.com/item/32826020679.html?spm=a2g0o.detail.pcDetailTopMoreOtherSeller.8.13e20tXG0tXGm5&gps-id=pcDetailTopMoreOtherSeller&scm=1007.40000.327270.0&scm\\_id=1007.40000.327270.0&scm-url=1007.40000.327270.0&pvid=aba505bf-ca4f-4815-abe0-5ec3232bc843&t=gps-id:pcDetailTopMoreOtherSeller,scm-url:1007.40000.327270.0,pvid:aba505bf-ca4f-4815-abe0-5ec3232bc843,tpb\\_buckets:668%232846%238111%231996&pdp\\_npi=4%40dis%21EUR%211.38%210.93%21%21%211.46%210.98%21%40211b600217168207864201249ee288%2164980637808%21rec%21NL%21%21AB&utparam-url=scene%3ApcDetailTopMoreOtherSeller%7Cquery\\_from%3A](https://nl.aliexpress.com/item/32826020679.html?spm=a2g0o.detail.pcDetailTopMoreOtherSeller.8.13e20tXG0tXGm5&gps-id=pcDetailTopMoreOtherSeller&scm=1007.40000.327270.0&scm_id=1007.40000.327270.0&scm-url=1007.40000.327270.0&pvid=aba505bf-ca4f-4815-abe0-5ec3232bc843&t=gps-id:pcDetailTopMoreOtherSeller,scm-url:1007.40000.327270.0,pvid:aba505bf-ca4f-4815-abe0-5ec3232bc843,tpb_buckets:668%232846%238111%231996&pdp_npi=4%40dis%21EUR%211.38%210.93%21%21%211.46%210.98%21%40211b600217168207864201249ee288%2164980637808%21rec%21NL%21%21AB&utparam-url=scene%3ApcDetailTopMoreOtherSeller%7Cquery_from%3A)

**For the SPST on/off power switch and the DPDT on-on switch for the sense input:**

[https://nl.aliexpress.com/item/1005004621032150.html?spm=a2g0o.productlist.main.11.13c720091VmP3b&algo\\_pvid=09f8f184-53d4-42b0-a383-bd63d7fd38d2&algo\\_exp\\_id=09f8f184-53d4-42b0-a383-bd63d7fd38d2-5&pdp\\_npi=4%40dis%21EUR%213.14%210.93%21%21%213.33%210.99%21%40211b600417168206024713778eddc9%2112000029863073077%21sea%21NL%210%21AB&curPageLogUid=h3XMLsd0geaE&utparam-url=scene%3Asearch%7Cquery\\_from%3A](https://nl.aliexpress.com/item/1005004621032150.html?spm=a2g0o.productlist.main.11.13c720091VmP3b&algo_pvid=09f8f184-53d4-42b0-a383-bd63d7fd38d2&algo_exp_id=09f8f184-53d4-42b0-a383-bd63d7fd38d2-5&pdp_npi=4%40dis%21EUR%213.14%210.93%21%21%213.33%210.99%21%40211b600417168206024713778eddc9%2112000029863073077%21sea%21NL%210%21AB&curPageLogUid=h3XMLsd0geaE&utparam-url=scene%3Asearch%7Cquery_from%3A)

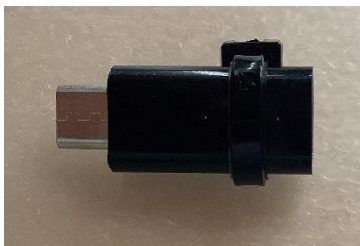
**Two Double 4mm Binding posts (for the main and sense inputs):**

[https://nl.aliexpress.com/item/1005006993637978.html?src=google&src=google&albch=shopping&acnt=708-803-3821&slnk=&plac=&mtctp=&albbt=Google\\_7\\_shopping&gclsrc=aw.ds&albagn=888888&isSmbAutoCall=false&needSmbHouyi=false&src=google&albch=shopping&acnt=708-803-3821&slnk=&plac=&mtctp=&albbt=Google\\_7\\_shopping&gclsrc=aw.ds&albagn=888888&ds\\_e\\_adid=&ds\\_e\\_matchtype=&ds\\_e\\_device=c&ds\\_e\\_network=x&ds\\_e\\_product\\_group\\_id=&ds\\_e\\_product\\_id=nl1005006993637978&ds\\_e\\_product\\_merchant\\_id=107685434&ds\\_e\\_product\\_country=NL&ds\\_e\\_product\\_language=nl&ds\\_e\\_product\\_channel=online&ds\\_e\\_product\\_store\\_id=&ds\\_url\\_v=2&albcv=19996252768&albag=&isSmbAutoCall=false&needSmbHouyi=false&gad\\_source=1&gclid=Cj0KCQjw3tCyBhDBARIsAEY0XNkM-C99DVmCVJD7q6hpzAQ7BVQk5Jpec9cncQ3TRbGqM05Pp4N1SW4aAtAMEALw\\_wcB&aff\\_fcid=49db050fc73e43d88329da19ac360644-1716820282761-08537-UneMJZVf&aff\\_fsk=UneMJZVf&aff\\_platform=aaf&sk=UneMJZVf&aff\\_trace\\_key=49db050fc73e43d88329da19ac360644-1716820282761-08537-UneMJZVf&terminal\\_id=37b0b5df1e714a659472cd0fb08fa9b5&afSmartRedirect=y](https://nl.aliexpress.com/item/1005006993637978.html?src=google&src=google&albch=shopping&acnt=708-803-3821&slnk=&plac=&mtctp=&albbt=Google_7_shopping&gclsrc=aw.ds&albagn=888888&isSmbAutoCall=false&needSmbHouyi=false&src=google&albch=shopping&acnt=708-803-3821&slnk=&plac=&mtctp=&albbt=Google_7_shopping&gclsrc=aw.ds&albagn=888888&ds_e_adid=&ds_e_matchtype=&ds_e_device=c&ds_e_network=x&ds_e_product_group_id=&ds_e_product_id=nl1005006993637978&ds_e_product_merchant_id=107685434&ds_e_product_country=NL&ds_e_product_language=nl&ds_e_product_channel=online&ds_e_product_store_id=&ds_url_v=2&albcv=19996252768&albag=&isSmbAutoCall=false&needSmbHouyi=false&gad_source=1&gclid=Cj0KCQjw3tCyBhDBARIsAEY0XNkM-C99DVmCVJD7q6hpzAQ7BVQk5Jpec9cncQ3TRbGqM05Pp4N1SW4aAtAMEALw_wcB&aff_fcid=49db050fc73e43d88329da19ac360644-1716820282761-08537-UneMJZVf&aff_fsk=UneMJZVf&aff_platform=aaf&sk=UneMJZVf&aff_trace_key=49db050fc73e43d88329da19ac360644-1716820282761-08537-UneMJZVf&terminal_id=37b0b5df1e714a659472cd0fb08fa9b5&afSmartRedirect=y)

**Four Rubber feet for the enclosure:**

[https://nl.aliexpress.com/item/1005006140637202.html?spm=a2g0o.productlist.main.11.5f006777weRaLJ&algo\\_pvid=b57c2085-1b92-44cf-9603-8b2d2531de0d&algo\\_exp\\_id=b57c2085-1b92-44cf-9603-8b2d2531de0d-5&pdp\\_npi=4%40dis%21EUR%215.76%210.93%21%21%2144.24%217.14%21%40211b600417168209006953353eddc9%2112000035941530008%21sea%21NL%210%21AB&curPageLogUid=qmO3vVLQShF4&utparam-url=scene%3Asearch%7Cquery\\_from%3A](https://nl.aliexpress.com/item/1005006140637202.html?spm=a2g0o.productlist.main.11.5f006777weRaLJ&algo_pvid=b57c2085-1b92-44cf-9603-8b2d2531de0d&algo_exp_id=b57c2085-1b92-44cf-9603-8b2d2531de0d-5&pdp_npi=4%40dis%21EUR%215.76%210.93%21%21%2144.24%217.14%21%40211b600417168209006953353eddc9%2112000035941530008%21sea%21NL%210%21AB&curPageLogUid=qmO3vVLQShF4&utparam-url=scene%3Asearch%7Cquery_from%3A)

**USB-micro to USB-C adapter**



To bring the ESP32 micro-USB connector to the front panel. Shown here with a tie-wrap installed.

**TO-220 isolators for the LM45 and the L-shape rails for the heatsink/fan mount and silicon pads for the LM35**

[https://nl.aliexpress.com/item/1005003600636535.html?spm=a2g0o.productlist.main.5.2d6f745bfBK0XB&algo\\_pvid=e590fb4f-7700-4df9-9a37-41cd1e558271&algo\\_exp\\_id=e590fb4f-7700-4df9-9a37-41cd1e558271-2&pdp\\_npi=4%40dis%21EUR%211.76%210.93%21%21%211.86%210.98%21%40211b600417168210999308410eddc9%2112000026448146183%21sea%21NL%210%21AB&curPageLogUid=SUDuTFwmZYuM&utparam-url=scene%3Asearch%7Cquery\\_from%3A](https://nl.aliexpress.com/item/1005003600636535.html?spm=a2g0o.productlist.main.5.2d6f745bfBK0XB&algo_pvid=e590fb4f-7700-4df9-9a37-41cd1e558271&algo_exp_id=e590fb4f-7700-4df9-9a37-41cd1e558271-2&pdp_npi=4%40dis%21EUR%211.76%210.93%21%21%211.86%210.98%21%40211b600417168210999308410eddc9%2112000026448146183%21sea%21NL%210%21AB&curPageLogUid=SUDuTFwmZYuM&utparam-url=scene%3Asearch%7Cquery_from%3A)

**Bottom fan mount:**

M3x30mm Screws, rings, self-locking nuts, nylon rings.

**OLED display mount:**

8xM2 nuts, 4xM2 flat washers

**Heatsink mount:**

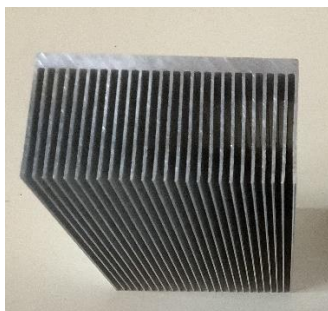
Aluminium L-strip 15x15x1mm 2x 90mm long

Your local DIY store.

**Main Heatsink:**

100x60x36mm

[https://nl.aliexpress.com/item/1005005795216874.html?spm=a2g0o.detail.pcDetailTopMoreOtherSeller.7.2c04stAXstAXYL&gps-id=pcDetailTopMoreOtherSeller&scm=1007.40000.327270.0&scm\\_id=1007.40000.327270.0&scm-url=1007.40000.327270.0&pvid=e745e66a-a627-4546-9679-3ce570f7cdcc&t=gps-id:pcDetailTopMoreOtherSeller,scm-url:1007.40000.327270.0,pvid:e745e66a-a627-4546-9679-3ce570f7cdcc,tpb\\_buckets:668%232846%238110%231995&pdp\\_npi=4%40dis%21EUR%2115.30%210.91%21%21%21117.68%216.96%21%402103872a17268410663474898ef22d%2112000034413592877%21rec%21NL%21%21ABX&utparam-url=scene%3ApcDetailTopMoreOtherSeller%7Cquery\\_from%3A](https://nl.aliexpress.com/item/1005005795216874.html?spm=a2g0o.detail.pcDetailTopMoreOtherSeller.7.2c04stAXstAXYL&gps-id=pcDetailTopMoreOtherSeller&scm=1007.40000.327270.0&scm_id=1007.40000.327270.0&scm-url=1007.40000.327270.0&pvid=e745e66a-a627-4546-9679-3ce570f7cdcc&t=gps-id:pcDetailTopMoreOtherSeller,scm-url:1007.40000.327270.0,pvid:e745e66a-a627-4546-9679-3ce570f7cdcc,tpb_buckets:668%232846%238110%231995&pdp_npi=4%40dis%21EUR%2115.30%210.91%21%21%21117.68%216.96%21%402103872a17268410663474898ef22d%2112000034413592877%21rec%21NL%21%21ABX&utparam-url=scene%3ApcDetailTopMoreOtherSeller%7Cquery_from%3A)



### Two Standoffs for the PCB:

Four 30mm M3 standoffs, screwed together to get the 60 mm height. I'm using M3 screws, rings and nuts to fasten them, and also adjust the height.

[https://nl.aliexpress.com/item/1005006201670859.html?spm=a2g0o.productlist.main.43.4ca97687e aHHDP&algo\\_pvid=c1665eca-7a20-451e-94b5-16e1ba2e0f6b&algo\\_exp\\_id=c1665eca-7a20-451e-94b5-16e1ba2e0f6b-21&pdp\\_npi=4%40dis%21EUR%213.10%213.10%21%21%213.29%213.29%21%40211b801b17168213555486244e0284%2112000036249519037%21sea%21NL%210%21AB&curPageLogUid=8EM8qmvjz LI&utparam-url=scene%3Asearch%7Cquery\\_from%3A](https://nl.aliexpress.com/item/1005006201670859.html?spm=a2g0o.productlist.main.43.4ca97687e aHHDP&algo_pvid=c1665eca-7a20-451e-94b5-16e1ba2e0f6b&algo_exp_id=c1665eca-7a20-451e-94b5-16e1ba2e0f6b-21&pdp_npi=4%40dis%21EUR%213.10%213.10%21%21%213.29%213.29%21%40211b801b17168213555486244e0284%2112000036249519037%21sea%21NL%210%21AB&curPageLogUid=8EM8qmvjz LI&utparam-url=scene%3Asearch%7Cquery_from%3A)

### Wire crimp connectors for the heavy duty wires for the main input (10A minimum!)

[https://nl.aliexpress.com/item/1005005738838654.html?spm=a2g0o.productlist.main.1.490c7e76U kgn7C&algo\\_pvid=8adb5801-7605-48ce-b92f-a7cbc3ca99d5&algo\\_exp\\_id=8adb5801-7605-48ce-b92f-a7cbc3ca99d5-0&pdp\\_npi=4%40dis%21EUR%2123.73%210.93%21%21%21182.38%217.14%21%40211b619a17168216939968441e1157%2112000034168670880%21sea%21NL%210%21AB&curPageLogUid=QiBeLupl CDFR&utparam-url=scene%3Asearch%7Cquery\\_from%3A](https://nl.aliexpress.com/item/1005005738838654.html?spm=a2g0o.productlist.main.1.490c7e76U kgn7C&algo_pvid=8adb5801-7605-48ce-b92f-a7cbc3ca99d5&algo_exp_id=8adb5801-7605-48ce-b92f-a7cbc3ca99d5-0&pdp_npi=4%40dis%21EUR%2123.73%210.93%21%21%21182.38%217.14%21%40211b619a17168216939968441e1157%2112000034168670880%21sea%21NL%210%21AB&curPageLogUid=QiBeLupl CDFR&utparam-url=scene%3Asearch%7Cquery_from%3A)

### An example for the rotary encoder knob: (eat your hart out...)

[https://www.aliexpress.com/item/1005006832967267.html?spm=a2g0o.productlist.main.35.7b7d1b1cOOB9Nk&algo\\_pvid=71978a98-8bff-4885-89eb-4c9ded82aa0f&algo\\_exp\\_id=71978a98-8bff-4885-89eb-4c9ded82aa0f-17&pdp\\_npi=4%40dis%21EUR%211.62%211.62%21%21%211.72%211.72%21%40211b615317168221322161616e35bc%2112000038448283145%21sea%21NL%210%21AB&curPageLogUid=jStiSbQpth MK&utparam-url=scene%3Asearch%7Cquery\\_from%3A](https://www.aliexpress.com/item/1005006832967267.html?spm=a2g0o.productlist.main.35.7b7d1b1cOOB9Nk&algo_pvid=71978a98-8bff-4885-89eb-4c9ded82aa0f&algo_exp_id=71978a98-8bff-4885-89eb-4c9ded82aa0f-17&pdp_npi=4%40dis%21EUR%211.62%211.62%21%21%211.72%211.72%21%40211b615317168221322161616e35bc%2112000038448283145%21sea%21NL%210%21AB&curPageLogUid=jStiSbQpth MK&utparam-url=scene%3Asearch%7Cquery_from%3A)

### Solder lugs:

For 4mm binding posts



### Two TO-220 Heatsinks for the NFET's

V5630-T from Assmann WSW Components, Digikey partnumber AE10898-ND



### Two BNC connectors

Adam Tech Digikey p/n 2057-RF1-106-D-00-50-HDW-ND



### Wall-Wart 12V 500mA

One word of caution about the wall-wart. After many months of working with the unit, and very frequently turning it on and off, the main relay stopped working. It turned out that the 12V coil winding was open. While searching for a possible cause, I noticed that the 12V from the wall-wart I was using was slightly above 15V. This was not a switching supply, but one with a transformer. The data sheet says that 130% or 15.6V for the relay should be within specifications, but still. Because the instrument only draws about 300mA maximum, it can be that the wall-wart output voltage is higher than 15V. I'm now using one that outputs 12.2V, even with no load.