# ISAN - Integrated System for Autonomous Navigation

An open-source YOLOL project made by **Collective** for the Starbase Community


Document author : <D:\Solonerus>, <C:\Azurethi>, <F:\Zaff>



Date of creation : 01.08.2021
Last updated : 09.08.2021
Version number : 2.3


---

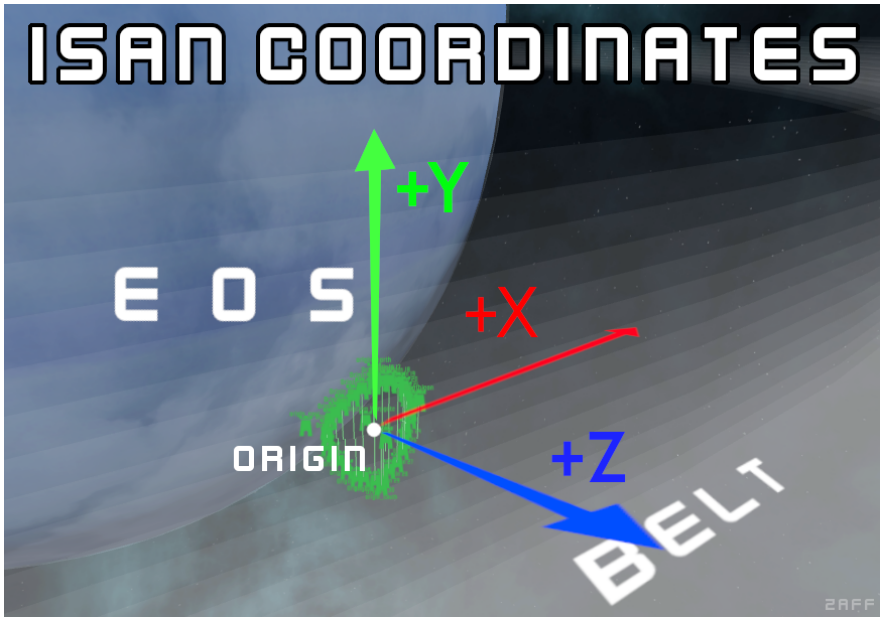
<< PUBLIC RELEASE >>

# Table of content

>> Introduction 3
>> The modes 4
>> Installing ISAN Mono 5
>> Installing ISAN Quad 6
>> ISAN YOLOL code 7
>> ISAN Errors 8
>> Streamer Mode / Reboot 8
>> Modules 9
>> FAQ 10
>> Credits & Commentary 11

# >> Introduction

ISAN is a **navigation system** within Starbase, developed by Collective. When installed on a ship, it **calculates your X, Y, and Z coordinates in space.** The coordinates are relative to the Origin 'ringle', as show in this image:

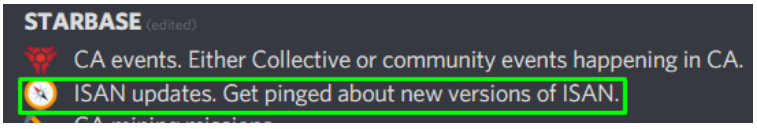



| Positive axis | Orientation | Towards beacon |
|---|---|---|
| **+X** | Sideways, across the belt. "Right" if looking at planet Eos from Origin spawn. | origin_east |
| **+Y** | "Up" from Origin. The same hemisphere that the sun orbits. | origin_north |
| **+Z** | Into the belt, away from planet Eos. | |

**Limitations**

- ISAN has a maximum range of 900-1000 km, depending on direction.
- ISAN gradually loses accuracy when approaching max range.
- In ship workshop / test flight, the Z and Y will switch places.

From everyone here at **Collective R&D**, particularly the **ISAN development team**, we **hope you enjoy ISAN**! Subscribe to updates in the **#notifications** channel in the Collective Discord to get notified when a new version of ISAN is released.




We also have a channel for `#isan_tech_support` but you may find that reading through this document thoroughly will provide most answers.

# >> The modes

ISAN has two modes; **Mono** and **Quad**

- **ISAN Mono** only requires 1 reciever but is **less accurate** while moving.
- **ISAN Quad** requires **4** recievers to retain **good accuracy** while moving.
    - *In case of receiver damage, **Quad** will try to switch back into **Mono**.*

| | Mono (M) | Quad (Q) |
|---|---|---|
| Accuracy while moving | ±100m | **±50m** |
| Accuracy while stationary | **±1m** | ±5m |
| Required Nav Receivers | **1** | 4 |
| Required YOLOL chip | 1 Basic or Advanced* | |
| Max range from Origin | 900-1000 km | |
| Refresh rate** | 0.6 seconds | |

*__Basic chip__ grants __position__. You'll need an __advanced__ chip to also display __speed__.
** __Refresh rate__ is increased by 0.2 seconds when enabling __speed__ or __prediction__.

# >> Installing ISAN **Mono**

(Video installation guide)

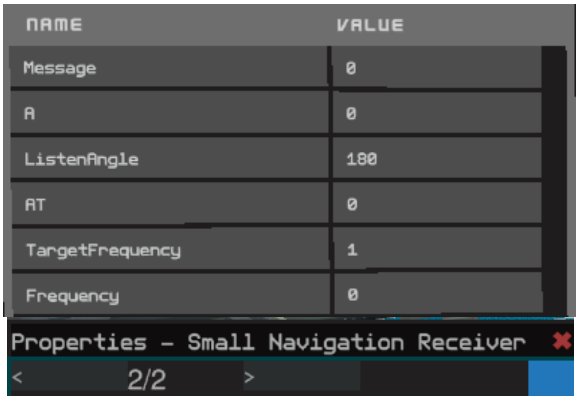
*Hardware requirements:*

0. A **power source.**
1. A **small navigation receiver.** Place it anywhere on your ship. Orientation does not matter. Ensure it's bolted to a **hardpoint** with cable connection.
2. A **yolol chip** inside a **yolol chip socket** / **chip reader**:
   - **Basic** chip if you only want to see position.
   - **Advanced** chip if you also want to see ship speed.
   Ensure cable connection to the socket/reader.
3. A visible **text panel**. Ensure the text panel has connection to a panel base.

*ISAN Mono Setup*

You will need to edit data fields.

- If in-**world**: Press U to open Universal tool then go to the data tab.
- If in the **Spaceship Designer**: Select object and watch the properties window.

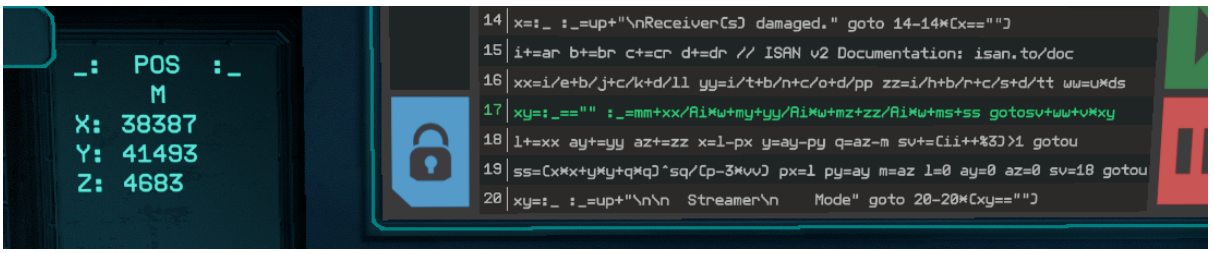



4. Open the **receiver**. Rename
   - **SignalStrength to A** and
   - **TargetMessage to AT**.
   If you cannot see any of this, press the **>**.
5. Set the **value** of **ListenAngle** to **180.**


6. Open the **text panel**. Rename **PanelValue** to **_** (underscore)

7. Copy and paste the newest ISAN code into the chip.

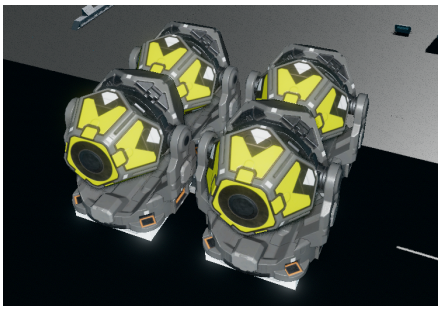
8. ISAN should now work. If it doesn't, try Reboot or see ISAN Errors. Enjoy!



# >> Installing ISAN **Quad**

⚠ **It is recommended that you understand ISAN Mono before installing ISAN Quad.**

*Hardware requirements:*



0. A **power source**.
1. Four **small navigation receivers.** Group them as **close together as possible** anywhere on your ship. Orientation does not matter. Ensure they're all bolted to **hardpoints** with cable connection.
2. A **yolol chip** inside a **yolol chip socket** / **chip reader**:
   - **Basic** chip if you only want to see position.
   - **Advanced** chip if you also want to see ship speed.
   Ensure cable connection to the socket/reader.
3. A visible **text panel**. Ensure the text panel has connection to a panel base.

*ISAN Quad setup:*

We will now refer to the four receivers as **A, B, C, D**. Order doesn't matter.

4. With **X** being a placeholder for the receiver letter; rename **SignalStrength** to **X** and **TargetMessage** to **XT** in all 4 receivers:

| | | | |
|---|---|---|---|
| Message | 0 | Message | 0 |
| A | 0 | B | 0 |
| ListenAngle | 180 | ListenAngle | 180 |
| AT | 0 | BT | 0 |
| Message | 0 | Message | 0 |
| C | 0 | D | 0 |
| ListenAngle | 180 | ListenAngle | 180 |
| CT | 0 | DT | 0 |

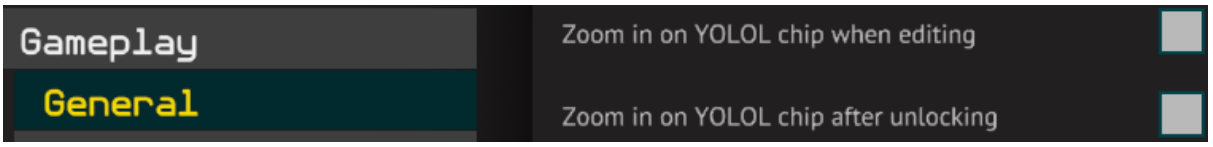
5. Set the **value** of **ListenAngle** in **all four receivers** to **180**.
6. Open the **text panel.** Rename **PanelValue** to **_** (underscore).


7. Copy and paste the newest ISAN code into the chip.
8. ISAN should now work. Since you installed Quad, it should also show "Q". If you see M (Mono) that means B, C or D is incorrect.


Enjoy ISAN!

# >> ISAN YOLOL code

We recommend enabling “Zoom in on YOLOL” in Starbase settings.




Use **isan.to/doc** to ensure you have the **newest** ISAN code (Currently 2.0).

1. Copy the **20 lines**, one at a time, into the YOLOL chip. Press **enter** to save.

You can edit **line 01** to enable **optional features**, each costing **0.2**s delay:

2. **Prediction option**: Set **po=0** to improve linear accuracy on ISAN Mono.
   ⚠ Note: Prediction only works on Mono. (Quad will still outperform Mono-P).
3. **Speed option**: Set **so=0** to add speed approximation.
   ⚠ Note: Requires an advanced chip. If using Mono, also enable Prediction.

```
01 Ai=1000 w=1000 po=1 so=1 COLLECTIVE+=ISAN sv=(1-so)*18 ds=so sq=0.5
02 z="origin_" a=z+"north" f=z+"south" g=z+"east" z+="west" ms=""
03 up=" POS  :_\n     " :at=a :bt=f :ct=g :dt=z :_=up+"\nBooting\nISAN"
04 ri=:_ mx=up+"Q\nX: " my="\nY: " mz="\nZ: " ss="" x/=so-1 ms="\n\nS: "
05 e=1279116.788 j=1279315.653 k=295462.833 ll=-202102.766 p=60 mo="M"
06 t=-218955.76 n=319959.864 o=1386614.499 pp=1387810.136 vv=15+po
07 h=-159981.854 r=-159995.737 s=159977.118 tt=160000.474 v=1000000
08 i=v-:a b=v-:b c=v-:c d=v-:d i*=i b*=b c*=c d*=d u/=:a u=8 mm=mx goto16
09 :at=f i=v-:a i*=i ar=(i-la)/4 la=i u/=:a u=10 mm=up+mo+"\nX: " gotovv
10 :at=g b=v-:a b*=b br=(b-lb)/4 lb=b u/=:a u=11 gotovv
11 :at=z c=v-:a c*=c cr=(c-lc)/4 lc=c u/=:a u=12 gotovv
12 :at=a d=v-:a d*=d dr=(d-ld)/4 ld=d u/=:a u=9  gotovv
13 :_=up+"\n   Loss\n    Of\n  Signal!" goto 13-10*(:a>0)
14 x=:_ :_=up+"\nReceiver(s) damaged." goto 14-14*(x=="")
15 i+=ar b+=br c+=cr d+=dr // ISAN v2 Documentation: isan.to/doc
16 xx=i/e+b/j+c/k+d/ll yy=i/t+b/n+c/o+d/pp zz=i/h+b/r+c/s+d/tt ww=u*ds
17 xy=:_=="" :_=mm+xx/Ai*w+my+yy/Ai*w+mz+zz/Ai*w+ms+ss gotosv+ww+v*xy
18 l+=xx ay+=yy az+=zz x=l-px y=ay-py q=az-m sv+=(ii++%3)>1 gotou
19 ss=(x*x+y*y+q*q)^sq/(p-3*vv) px=l py=ay m=az l=0 ay=0 az=0 sv=18 gotou
20 xy=:_ :_=up+"\n\n  Streamer\n    Mode" goto 20-20*(xy=="")
```

*(Plaintext version here)*

# >> ISAN Errors

| Text on screen | Cause |
|---|---|
| `Loss of Signal` | Any of the radio receivers are not picking up a signal from the stations ISAN relies on. This will show when leaving ISAN range (900-1000km). |
| `Receiver(s) Damaged` | The "A" receiver is damaged or inaccessible. If ISAN Quad takes damage in other receivers, this message will be displayed until ISAN switches to Mono. |
| `Streamer Mode` *(Unable to exit)* | ISAN will default to Streamer Mode if the code has been copied incorrectly or if you're trying to use incompatible features like Speed on a basic chip. You will be unable to exit Streamer Mode until this has been corrected. |
| `_: 0` | The text panel is not connected to the ISAN chip. |

Other possible reasons ISAN doesn't work:

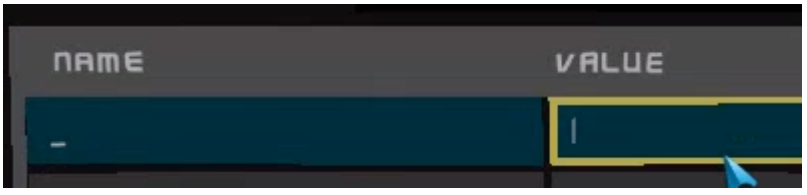
- You've copied the code incorrectly. Recheck that the first and last letter of each line is the same as on isan.to/doc code or copy it again.
- You've accidentally clicked into the chip code and added stray characters. Copy it again, careful not to hit other keys.
- You've confused **value** and **name.** Ensure receiver(s) and text panel matches those in the installation instructions.
- Other YOLOL chips may interfere with the receiver fields.

# >> Streamer Mode / Reboot

*"Have you tried turning it off and on again?" - ISAN Tech Support*

ISAN comes equipped with a **streamer mode** to hide your coordinates. It doubles as the way to reboot the system.

- To **toggle** streamer mode: Press **U** on the text panel and delete the entire **value** including the quotes (""). You can use Ctrl+A to do it faster.




- When toggling back, ISAN will reboot. Try doing this first if you encounter any issue or have changed settings.

# >> Modules

⚠ **Ignore** this section if using “standard ISAN”.
This is **only** necessary if using **external modules**.

Modules are a way for users to expand upon ISAN’s functionality. The ISAN Team is working on making the v1 modules compatible with v2. Until then, feel free to develop your own.

ISAN by default requires **no external memory fields except for the direct ‘_’ text panel.** If you wish to enable external modules:

- On YOLOL lines **16, 17 & 18,** prefix the variables **‘XX’**, **‘YY’** & **‘ZZ’** with a **‘:’**
- Install a **memory chip** containing the **‘XX’**, **‘YY’** and **‘ZZ’** fields.

# >> FAQ

| Question | Answer |
|---|---|
| Why won't my ISAN work? | Double-check tutorial steps, check ISAN errors, exact data field names, code equality. Then check the errors table. Reboot ISAN. Otherwise get help from someone who've installed ISAN or Collective's #isan_tech_support channel. |
| I bought a ship with ISAN. Why won't it work? | It's likely using old, outdated ISAN v1 code. You can upgrade to ISAN v2 using this doc. Note that any ISAN information or ships last updated before August 2021 is outdated. |
| Can I sell ISAN ships or chips? (Using ingame Starbase credits of course) | Yes. ISAN is free and open-source. |
| Why "ISAN"? | **I**ntegrated **S**ystem for **A**utonomous **N**avigation. Catchy acronym. Pronounced "Eye-Sand" without 'd'. It's not just "Space GPS", but a wider collection of navigation related tools developed by Collective. |
| How does ISAN work? | Multilateration of 4 station transmitters. |
| Why is Quad more accurate than Mono? | Q receives all 4 transmissions at once, while Mono cycles through each, taking samples from different locations when moving. |
| Why the 900-1000km range? | ISAN stops working if it loses connection to one of the 4 beacons near Origin, each with signal strength reaching 1000km. |
| Can ISAN be used to track me? | No. Receivers are one-way. |
| What is the ISAN.to Starmap? | An ISAN-compatible Starbase map developed by Collective. Note that usage of Starmap requires us to log certain information for analytics, debugging and preventing abuse. |
| Can ISAN.to be used to track me? | Not unless you post coordinates to a public layer. The service is run by Starmap's Webmaster strikeeaglechase. |
| Is ISAN licenced? | Yes, ISAN is licenced under GNU public licence v3. *(Only applies to our GitHub)* |

# >> Credits & Commentary

*ISAN began as a small project I made public on a whim, but has grown to be a main-stay of many Starbase ships. I've encountered hundreds of people on this journey, ranging from interested YOLOL developers to faction repersentatives, each a brighter spark than the last. It's a rollercoaster, but one I plan on staying on. Thank you reader for using ISAN, your kind words, support and exaltation have been a bright 'lighthouse' in the darkness.*

- *Solon, Kernel of Collective R&D and ISAN Project Leader*

Current v2 Version:

- **Solon** - *Project Leader*
- ***Azurethi*** - *Lead Developer, math wizard*
- ***Zaff -*** *Installation guide (this document)*
- ***CYLON members*** - *YOLOL debugging assistance*

Previous Versions:

- **Solon** - *Development of ISAN v0*
- **Lumi Virtual** - *Development of ISAN v1*
- **Strikeeaglechase** - *Development of offsets and ISAN code, ISAN Starmap*
- **MuNk** - *Code consultation*
- **Nordwolf** - *Development of ISAN 0.5*
- **Battle_Wrath** - *Various design ideas and general help*
- **Archduke** - *Invaluable support and document writeup*
- **Zaff** - *Usability consultation, document.*
- **Meboy100** - *Le rubber duck (test subject)*